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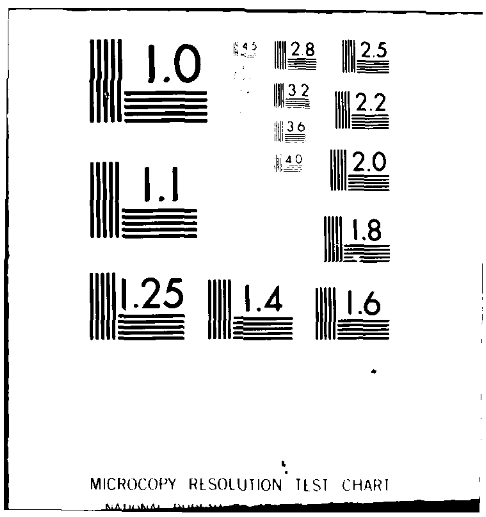
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PROGRAM MANAGEMENT PLAN FOR FISCAL YEARS 1981 THROUGH 1985

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents the BASIC Laboratory Program Description, Organization, and Tasks for the period of fiscal 1981 through 1985. Included are the project organization description, staffing plans, laboratory task plans with funding and manpower requirements.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

VOLUME II — APPENDICES

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

SECTION 1

INTRODUCTION

The BASIC laboratory integrates advanced avionic technology products into an advanced, distributed multiple processor architecture. The laboratory system configuration uses simulations, multiplex integration technology development models and various other equipment in an advanced system structure. This configuration can accept emerging technologies and demonstrate their capabilities. Technologies already under study in the laboratory include the Integrated Inertial Sensor Assembly (IISA), voice multiplex, data multiplex, fiber optics, and bus monitor.

The BASIC laboratory has supported such platforms as LAMPS, F-14, and CH-53, and offers the weapon system platform manager support in the following program phases:

PRE-DSARC I (Concept Formulation)

- Analyze risks
- Validate concepts supporting critical issues
- Evaluate/validate alternatives
- Identify/resolve problems
- Develop and evaluate architecture - multiplex/processing/system

PRE-DSARC II (Demonstration and Validation)

- Off-line (not in platform laboratory)
  - Independent Navy assessments/validations
  - Higher risk technology evaluation/validation/demonstration

POST-DSARC II

- Off-line - evaluation/validation/demonstration
  - Weapon system updates
  - Others, as required

1.1 PROGRAM OBJECTIVES

The BASIC program is an advanced integration activity whose primary objectives are to:

1. Guide the early development of technology toward specific mission requirements
2. Integrate advanced technology and hardware into a generic core avionic system configuration to validate and demonstrate their application to future avionic platforms
3. Assess technology off-line for a platform program during validation, DSARC II and full-scale development (FSD)
4. Evaluate and validate alternatives for platform program offices
5. Minimize risk and increase confidence in transitioning advanced technology and hardware to fleet use

1.2 PROGRAM OUTPUTS

The outputs of the program are:

1. Demonstrated technology products with risk assessments
2. Information for Program Management Administrators (PMA's) and program offices on technology for incorporation in their resepctive platforms
3. Information to technologists that validates their product's ability to meet functional requirements of future platforms
4. Documentation supporting DSARC I and DSARC II
5. Test plans and test reports
6. Technology assessments supporting Technology Assessment Annexes (TAA's)
7. Inputs to Decision Coordinating Papers (DCP's)
8. Inputs to preliminary and final Test and Evaluation Master Plans (TEMP's)
9. Evaluations of avionic architectures, technologies, alternatives, and technical risks
10. Reports from early integration of 6.2 and 6.3 developments into an advanced avionic system architecture in the BASIC laboratory

SECTION 2

BACKGROUND

The BASIC program was established to improve the Navy's transition process for emerging technologies from the concept stage through advanced development to the weapons systems platform and fleet use. The rapid advancement of technology to large scale integration (LSI) and very large scale integration (VLSI) of circuits has caused a revolution in application of digital techniques, size and weight reductions, and reliability.

System architectures have advanced along with multiplex integration technology, which frees the system of mammoth cable bundles, connectors, and point-to-point wiring. Multiplexing, which provides the transfer of information over a data bus, allows systems to be integrated horizontally instead of vertically as in the past. In vertical integration (Figure 2-1), each communications or sensor system is hardwired from antenna to display.

Horizontal integration (Figure 2-2) permits integration of the major control and display functions while providing localized control to be distributed to the individual avionic systems. Control and communications between centralized and localized activities take place over the multiplex bus. Functions can now be distributed or integrated in the most efficient manner for system operation, reliability, survivability, and operator interface.

The computer, which furnishes the computational and control support of an avionic system, is usually a single physical element (and a single point of failure). The multiplex bus structure allows computer power to be distributed throughout the architecture. Having distributed processors diminishes the impact of a single point of system failure and increases overall avionic system reliability. Figure 2-2 shows typical horizontal integration of avionics systems. The computer that furnishes the centralized control is backed up by another whose primary function is computational. In the vertical organization shown in Figure 2-1, each set of

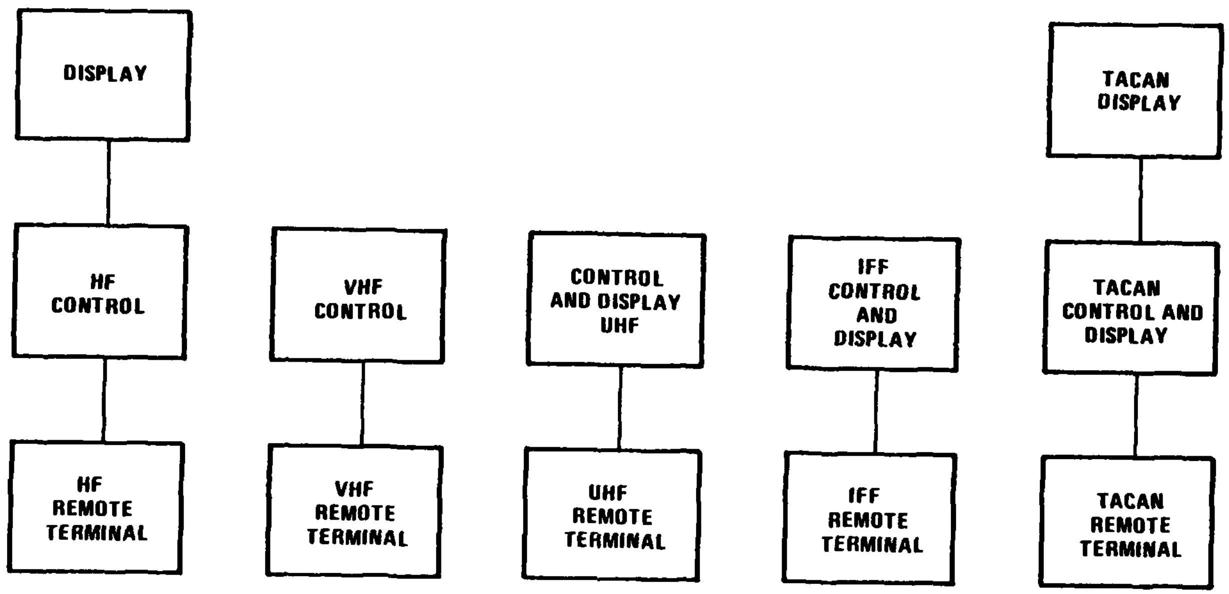

Figure 2-1. Typical Vertical Organization of Avionic Systems

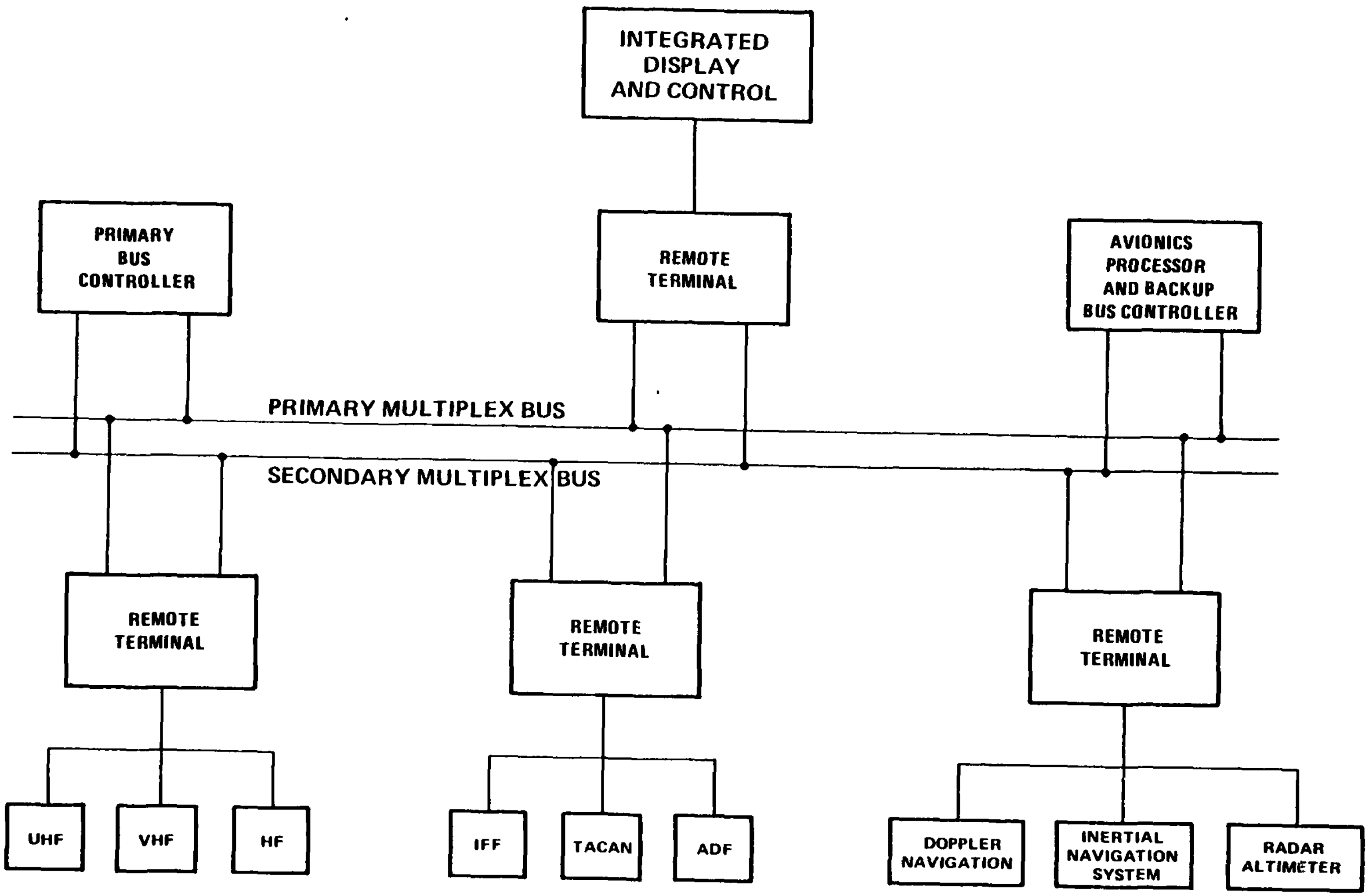

Figure 2-2. Typical Horizontal Organization of Avionic Systems on Multiplex Bus

slaved displays, controls, and sensing elements is totally dependent on one control element and one hardwired signal path. The horizontal organization implemented with a redundant multiplex bus architecture provides alternative signal paths and redundant control elements. This combination furnishes a high degree of reliability by diminishing the input of the failure of vital system elements.

Advances in circuit density, memory, and software have reduced the computer's size and increased its capability. Use of microprocessors, embedded in avionics subsystems, is increasing.

Integration of controls and display is designed to give the operator what he needs when he needs it. Simplification of the operator interface allows for greater operator efficiency. Interface integration via a common multiplex data path facilitates control and information data transfer for advanced integrated displays and controls. Advances in computer and microprocessor technology have also made possible the integration of displays and controls.

The BASIC Integration Laboratory has an advanced system architecture with advanced integration technology multiplex systems, actual avionic subsystems, and subsystem simulations. The advanced BASIC system architecture and configuration provides the capability to accept emerging technologies in the system environment and allows evaluation and demonstration of technologies in advanced system architectures for various platform applications.

The BASIC laboratory will continue to concentrate on the following technology areas which are particularly applicable to new platform requirements.

- Advanced avionic architecture
- Multiplexing implementation
- Controls and displays
- Navigation
- Communication
- Multisensor correlation
- Mission interfaces
- Tactical performance
- C^2 options

SECTION 3
PROGRAM DESCRIPTION

3.1 GENERAL DESCRIPTION

The BASIC laboratory evaluates new technologies as they might be used in proposed avionic platform applications. The laboratory, in its current form, represents a subset of the proposed architecture (Ref. Report No. NADC-79161-40, dated 17 May 1979). The present laboratory configuration is described in Section 3.2. The plan for BASIC during FY80 through FY84 outlines the steps for evolving from the present subset to the advanced system configuration described by the BASIC Laboratory Architecture Plan (Ref. Report No. NADC-79161-40, dated 17 May 1979). Section 3.3 outlines the enhancement to the BASIC laboratory's facilities and capabilities that will be made during FY81 through FY85.

3.2 LABORATORY DESCRIPTION

The equipment now operating in the BASIC laboratory represents the initiation of an advanced distributed processing architecture. The key element of this architecture is a set of redundant 1553 multiplex buses controlled by a Navy standard avionics computer (SAC), the AYK-14. Connected to the multiplex avionics bus are subsystems and units representing equipment currently used in avionics platforms, items being evaluated for avionic application, and other simulation, test, and support equipment.

The redundant 1553 multiplex buses carry control and data messages between the following functional groups of the system:

- Control, computational, and decision-making equipment
- Test equipment
- Simulation facilities
- Cockpit crew support
- Multipurpose interactive terminals

These functional groups are explained in detail below.

The two test equipment groups are the system test station and the special purpose test equipment. The system test station is an AN/UYK-15 computer with the following peripherals:

- (1) Hazeltine 2000 Terminal (with keyboard and CRT)
- (2) Pertec Magnetic Tape Units
- (1) Paper Tape Reader/Punch
- (1) Tektronix 4631 Hard Copy Unit
- (1) Tektronix 4051 Graphics Display Terminal
- (1) Dataproducts 2230 Printer
- (1) Card Reader
- (1) Wangco F2221 Disk
- (2) Kennedy 9100 Magnetic Tape Units

The special purpose test equipment tests multiplex terminals and simulates multiplex system operation. The real-time bus monitor checks the traffic on the multiplex bus. It can also capture selected data and monitor the condition of the bus controller. A single-command word generator and a command message generator input test traffic to the bus.

A VAX 11/780 computer and five Z-2 microcomputers provide BASIC's simulation capabilities. The VAX 11/780 simulates mission input including mission direction and environment. The Z-2 systems simulate various avionic sensors.

The cockpit crew interface to the BASIC avionics consists of a cockpit mockup with displays and controls, a voice multiplexing system, and a color graphics video terminal. The cockpit mockup furnishes a physically familiar operator (crewmember) interface to BASIC avionics but is flexible enough to incorporate new display and control approaches. This flexibility allows for evaluation of crew reaction to new equipment and techniques. The voice multiplex system is under evaluation in the BASIC laboratory. Demonstrations have shown that the 1553 bus

can be used for digitized voice traffic, alone or combined with normal avionic data messages. The color graphics video terminal is an experimental vehicle for improving communication with the aircraft crew.

The BASIC laboratory has two AYK-14 computers. Major software elements from air platform applications such as radar and communications are implemented on these AYK-14's, which communicate with other BASIC elements via the 1553 bus. This implementation aids in evaluating avionic software in a simulated environment. It allows study of both the effects of the simulation and the effectiveness of software modifications.

3.3 PROGRAM DESCRIPTION

The major BASIC program goals for FY81 through FY85 are fulfillment of the BASIC Architecture Plan, support of avionic platform programs, and installation of new technologies for evaluation in avionic systems. Realization of these three goals will improve the transition process, enhance the support services available to the technology and program offices, and strengthen the resources of the BASIC program.

3.3.1 Improvements in the Transition Process

The BASIC program enhances the transition process as follows:

- The BASIC laboratory can demonstrate the integration of technology products into a laboratory operational system. It then demonstrates the interoperability of the technology products with each other in the system configuration of the BASIC laboratory.
- System architectures can be demonstrated by the BASIC integrated generic configuration with the advanced technology products. The system incorporates ease of reconfiguration features.
- Scenarios for specific missions and specific platforms can be demonstrated in the laboratory so that the weapon system platform managers can verify that the technology products and the system architecture can perform through the mission scenarios for a specific platform.

The BASIC program enhances the technology transition to platforms as follows:

- The BASIC program provides a documented, demonstrated system and technology base for the program manager or platform office desiring data.
- Documentation analyses and reports are provided for the technology products operating in the BASIC laboratory system configuration.
- The laboratory provides a core configuration integrated with mission-specific subsystem technologies. The requested platform operation for a specific mission is tested and validated, the data are recorded and analyzed, and reports are provided.
- As a part of the operation of the technology products in the BASIC laboratory, algorithms and software modules for these products have been developed, demonstrated, and documented. Testing and validation are analyzed, reported, and documented and are available for those requiring the information.

3.3.2 Technology Interface

The BASIC program interfaces include the technology blocks and the technology directorates. The BASIC laboratory's generic core configuration and the integrated technology products represent advanced avionic systems. The generic core configuration may include the technologies from NAVAIRDEVCEN, the military services, and industry. The technology interfaces must include the applicable technologies being developed and consider the timing of their introduction into the BASIC laboratory. The interfaces required in the technology laboratory and an indication to the technologists regarding the system architecture will be provided. The laboratory schedule correlates advanced platforms and the windows of opportunity that occur for the transitioning of technology. Schedule differences for integrating technology development into the laboratory and the correlation with advanced platform windows of opportunity will be pointed out for resolution. The schedule and use of the BASIC laboratory's special facilities for the demonstration, test and evaluation of the technologist's product without the need for each technology to duplicate functions, subsystems, and interface that are available in the BASIC laboratory, should be exploited. Documentation,

findings, and recommendations developed by the laboratory as a result of testing and integration of technology products, as well as test and demonstration for specific platforms, will be provided to the technologists. The feedback from the laboratory will provide the technology groups with documented information on the performance of their products in the BASIC integration laboratory. It will also allow the evaluation of additional development work that may be needed and of any deficiencies.

3.3.3 PMA/Program Office Interface

The BASIC program provides the PMA's and program offices demonstrated and documented information on technology products integrated into a system configuration. The system configuration can be exercised to verify the specific platform mission requirement and system architecture. The availability of demonstrated, documented technology base information allows the PMA's to select the technologies for use on their platform with the minimal risk.

The BASIC program provides documented findings and recommendations from the testing of the technology products and system architecture in the laboratory. This documentation can be used to prepare requests for proposal (RFP's) and data packages for DSARC reviews.

The laboratory gives the program manager or weapon system project office a facility and capability to assess higher risk technologies off-line. This allows the PMA's and program offices to perform these higher risk assessments while their own platform prototype integration laboratory is conducting and continuing its test program. The results and documentation from the off-line demonstration can be integrated into the platform avionic system with known risk, so that the new technology can begin full-scale development.

Before establishment of the platform's avionic integration laboratory, the BASIC laboratory helps to determine the risk, performance, validation, and demonstration, and provides documentation of the advanced technologies and advanced system architectures.

The BASIC laboratory provides a focal point for the transitioning of technology to platforms. It helps maintain commonality between platforms with multimission, multiplatform avionic architectures and systems. It also provides for continuing traceability of technology from laboratory development phases to transition and use in a platform. This commonality and traceability provide long-term savings for support of the various aircraft that the Navy will employ. Logistics and maintenance, training, and operating costs can be reduced. The advanced technologies can be incorporated in new naval aircraft platforms, CILOP's, SLEP's, or updates.

3.3.4 BASIC Program Support Services

BASIC services to the naval air community include:

- Services to technology development projects

  1. Providing the systems application information required to enhance technological implementation by early integration of 6.2 developments into a core avionic laboratory system configuration
  2. Providing a technological risk assessment of the systems applicability for exploratory developments
  3. Providing the means for informing technologists of the functional requirements of future avionic systems, thereby enhancing the timeliness and suitability of technological developments
  4. Providing facilities to allow comprehensive testing of a technology product within an avionic system context. In addition, specialized test facilities available in the BASIC laboratory and common to a number of technology projects could be shared, thereby avoiding duplicated development, simulations, emulations, and expenditures.
  5. Coordinating technology flight tests to provide comprehensive testing and lower flight test costs by sharing test support resources
  6. Enhancing PMA and program office usage of technology development products

- BASIC support to NAVAIR-03 technology administrators

  1. Recommending BASIC interface and integration of NAVAIR technology project products at NAVAIRDEVCEN in terms of priority, time-phasing, and levels of effort in direct support of specific mission requirements

2. Recommending new technology developments to NAVAIR for its consideration and support

3. Integrating the technology developments sponsored by the different NAVAIR technology administrators in the BASIC laboratory. Providing demonstrations of interoperability with other subsystems and systems validation

4. Supporting the individual technology administrator by giving product guidance to his technology development projects and by providing access to a laboratory that allows the product to be tested without simulation or duplication of external interfaces

- BASIC assistance to the NAVAIRDEVCEN Platform Program Offices and NAVAIR Project Management Offices

1. Providing validated and demonstrated advanced avionic system configuration options for PMA consideration in the early phases of the weapon system procurement

2. Implementing system architectures that reflect Navy policy on operational readiness and low life-cycle costs with a stress on functional commonality and ongoing standards programs which allow engineering developments and operational support costs to be spread over a number of projects

3. Providing input data for DSARC reviews and RFP preparation to PMA's when requested.

4. Demonstrating to platform sponsors the applicability of exploratory developments in a systems environment to encourage their incorporation in future avionic systems

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SECTION 4
BASIC PROJECT ORGANIZATION

4.1 ORGANIZATIONAL RELATIONSHIPS

The NAVAIRDEVCEN organization with the interfaces and relationships of the platform program offices and the BASIC are shown in Figure 4-1. The platform program office provides system requirements to the center design team (CDT) during the concept formulation stage (6.2). The center design team conceives functional avionic descriptions and alternatives which are output periodically as the concept formulation stage progresses.

Information handling (IH) provides the BASIC with alternatives for computer architecture, bussing arrangements, and data processing load partitioning. An implementation plan for the BASIC laboratory avionic configuration architecture was prepared by IH for the BASIC laboratory. IH also provides standards and guidance in the areas of languages, software, data processing, and signal processing to the technology directorates. This guidance is to ensure integrability of technology projects in the BASIC laboratory and transferability to advanced platforms.

BASIC contacts the technology directorates to determine the availability of technology products and provides a generic avionic system configuration for the integration of the products. This facility is used to implement system and processor alternatives, for which it provides documented evaluation and validation.

The BASIC project provides data packages to the platform program offices as required to support DSARC approval and for RFP preparation. It utilizes NAVAIRDEVCEN simulations such as AIDS programs, KIWI, LAMPS, and PROTEUS, as applicable, to develop interactive displays and controls for the man-machine interface and/or for subsystem simulations. Simulation programs developed by Government-established laboratories, such as Air Force, DAIS, NASA, AMES, etc., will be investigated and used where feasible.

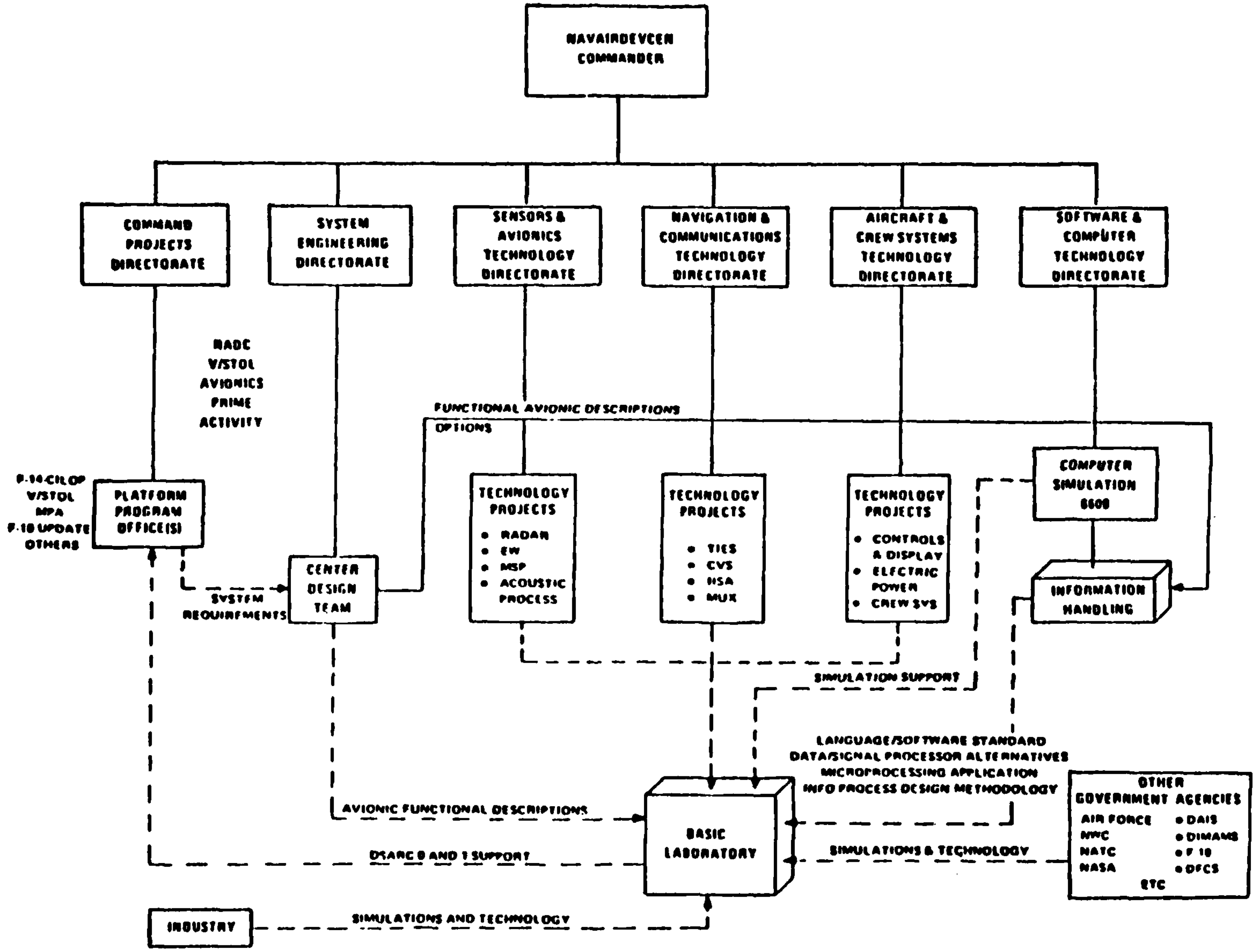

Figure 4-1. Organizational Relationships

In the validation phase after DSARC I, the BASIC interfaces with the platform program office and the CDT or system engineering team for designation of higher risk alternatives to be validated and evaluated prior to DSARC 2 and full-scale development. This BASIC support to the platform program offices includes data packages for the higher risk technological alternatives assessments.

4.2 BASIC PROGRAM MANAGEMENT ORGANIZATION

The organization of the BASIC program (see Figure 4-2) consists primarily of the Project Director, the Program Administrator, and a staff of engineers for software, system integration, technology and platform interface, and system test. The lead engineers will function immediately under the Project Director.

4.2.1 Project Director

The BASIC Project Director is responsible for the overall management of the BASIC program in consonance with the objectives and functions delineated in Section 1 and within the BASIC program charter. Within the scope of the program, the Project Director has the specific authority and responsibility to:

1. Establish overall and detailed BASIC program plans and update such plans as appropriate
2. Approve the proposed plan of execution, including the technical approach, the scope and schedule of work, and the cost of efforts requiring program funds; negotiate for such agreements with NAVAIRDEVCEN; and support the negotiations for contractor work
3. Establish management control techniques and procedures to provide accurate and comprehensive information concerning the status and progress of the BASIC program
4. Maintain management and technical liaison with sponsors and other interfacing activities, including organizations both within and outside NAVAIRDEVCEN, as required to accomplish the BASIC objectives
5. Review, approve, and allocate financial resources
6. Prepare or approve all official program correspondence
7. Plan, organize and administer the BASIC program

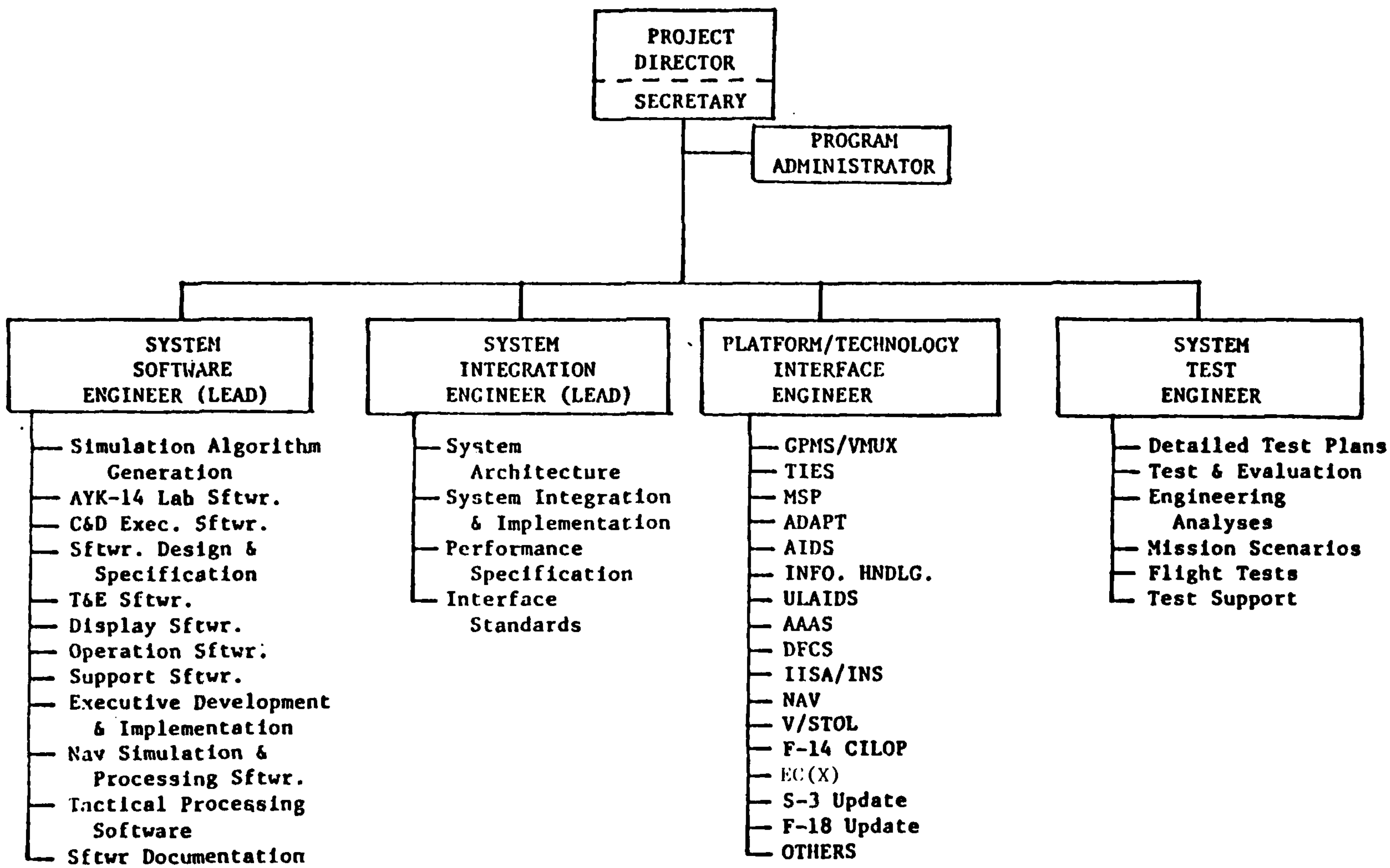

Figure 4-2. BASIC Program Organization

4.2.2 Program Control and Administration

The Program Administrator, who reports directly to the Project Director, has as his primary responsibility the performance of the administrative functions associated with financial control of BASIC program funds. In addition to this primary responsibility, he will perform the function of procurement administration, including the preparation of IDWA's and paper work associated with contracting. He will be the program's primary point of contact with the supply section and will also coordinate and make arrangements for office services.

The Program Administrator is also responsible for all matters pertaining to documentation control and configuration management. He will establish and maintain a Project Control System (PCS), analyze the data reported by this system, reduce the data to forms suitable for use by the Project Director, and generate the semiannual management reports.

In addition, the Program Administrator is responsible for the preparation and publication of all formal reports, specifications, and other forms of documentation produced by the BASIC program. He will establish and maintain an organized technology data base. He will also establish and maintain a configuration management system to exercise control over the hardware and software in the integrated avionic configurations undergoing evaluation in the BASIC.

4.2.3 System Integration Engineer (Lead)

The System Integration Engineer has the responsibility for converting the BASIC Laboratory Architecture Plan into working configurations and for using the facilities of the BASIC to validate and evaluate these configurations, platform alternatives, options and technological issues. He is, therefore, responsible for the following specific tasks:

1. Detailed design of the BASIC avionic system configuration and architecture.
2. Definition of interface standards.

3. Implementation of the BASIC laboratory avionic system architecture.
4. CH-53 avionics integration and test in the BASIC laboratory.
5. Purchase specifications for hardware and hardware integration for platform support.
6. Specifying and implementing system/hardware interfaces of the S-3 SRF and BASIC's multiplex system, the AYK-14 and the UYK-15.
7. Configure the laboratory for BASIC/MSC simulation for the F-14.
8. Integration of the avionic configurations and advanced technology products.
9. Specific platform (e.g., F-14 CILOP, EC(X), F-18 update) configurations and architecture integration, implementation, or accommodations.
10. Installation of the avionic hardware.
11. Development or specification of the requirement for simulators or emulators.
12. Determination of information flow requirements.

In the performance of these tasks, the lead integration engineer may direct and guide other engineers and technicians assigned to him. He shall:

1. Be responsible for the technical quality of the output of those he directs and the accomplishment of tasks on schedule and within the budget assigned.
2. Inform the Project Director of current status and anticipated problems.
3. Provide a monthly progress report stating past month accomplishments and those planned for the following month.
4. Assist the Project Director or designee in project planning, funding, and manning requirements.
5. Provide delineation of IDWA tasks.
6. Provide determination of level of efforts for tasks done for/or by BASIC.

4.2.4 System Test Engineer

The System Test Engineer is responsible to the Project Director for the conduct of BASIC laboratory demonstrations, tests, and evaluations. He is

responsible for the preparation of detailed test plans and procedures, data reduction and analysis, and the generation of test reports including findings and recommendations. Testing and reporting is to be done with an awareness of the potential platform application and the need for data packages supporting DSARC 1 and DSARC 2 reviews. He is also responsible for flight test and evaluation support including, if required, flight test plans, test operations, data analysis/ reduction, test support including provision of support equipment, maintenance and repair, and spares provisioning.

The lead system test engineer is responsible for the following specific tasks:

1. Preparation of detailed test plans
2. Preparation of laboratory operating procedures and the scheduling of laboratory operations
3. Conducting demonstration, tests, and evaluations
4. Assistance, as required, in flight test plans generation, flight test support, analysis of data, and reporting of results
5. Analysis and reduction of data
6. Generation of test reports, recommendations, findings and generation of specific platform applications and data packages as requested by the BASIC Project Director in support of program offices, e.g., CH-53, EC(X), S-3A, and F-14.

4.2.5 Interface Engineer

The Interface Engineer is responsible to the Project Director for providing technical liaison with the various technologists. This liaison is for those technology products that will be integrated into the laboratory core avionic system for specific applications. Further, the liaison will allow the technologists to use the laboratory for the development, test, and evaluation of their products with the available BASIC system interfaces and the testing capability existing in the laboratory. Documentation and data, including findings and recommendations from the BASIC data base, will be made known and accessible to the technologists. Other useful BASIC documentation will include future platform

windows of opportunity, mission and scenarios to be demonstrated, and scheduling that will correlate BASIC outputs with platform development schedules.

The technology interface engineer will provide technological liaison with the following:

- TIES
- MSP
- APP
- Information Handling
- ULAIDS
- AAES/SOSTEL
- VRS, VIS
- AAA S/A^2I^2
- DFCS
- HSA/RLGN/INS
- Other technologies as they emerge in industry, the other services, and other Navy laboratories.

The Interface Engineer is also responsible for technical liaison with the platform offices, providing them with information concerning the documentation available from the BASIC data base and the BASIC capabilities that already exist or will be in existence. Liaison should be provided to the program offices for the F-14 CILOP, the S-3A Update, the F-18 Update, EC(X) and other platform programs as they appear. The interface should include:

1. Platform development schedule and needs
2. Avionic system functional requirements (critical issues, alternatives, and options)
3. Platform missions and scenarios
4. BASIC documentation applicable to platform needs
5. BASIC DT&E and data packages that can be generated to support the platform manager for DSARC I review, RFP preparation, DCP preparation, and Technology Assessment Annex preparation

6. Off-line risk assessments and data packages that are needed to support DSARC 2
7. Support for preparation of TEMP for DSARC 2 and preliminary TEMP for DSARC 1
8. BASIC schedule/plans and correlation with platform milestones

4.2.6 System Software Engineer (Lead)

The Software Engineer will be responsible for the definition of software requirements, software specifications, and software development, installation, testing, and debugging operations. He will be responsible for maintenance and support for all software required and used in the operation of the BASIC laboratory avionic system and conducting demonstrations, tests, and evaluations. The software engineer will be responsible for soft documentation. These tasks include:

1. Simulation algorithms acquisition or generation
2. AYK-14 laboratory software and system executive development
3. Accommodation of technology products by BASIC operational software and T&E software
4. T&E software
5. T&E data reduction and software support for platform office data packages
6. Complete control and display software executive and operational software development, installation, debug and operational support
7. Software installation, debug and operational support including operator training and manuals
8. Multiplex terminal programming and modifications (Data and Voice) and bus controller programming and modifications
9. Platform software reconfigurations for DT&E support
10. Z-2 software and subsystem simulation programming
11. Software for the conduct of mission and scenario demonstrations for designated platforms
12. Define and generate software documentation
13. Review and critique contractor supplied software documentation

14. Code BASIC/MSC/MUX Executive software, debug software, design mux controller hierarchy and control method, monitor contractor algorithms/structure and routines used to derive MSC algorithms, debug software of the MSC simulation (F-14).

15. Support the use of the VAX 11780 for the acoustic performance prediction (APP) software development.

16. Support the CH-53 simulation software development using the VAX 11780 or Z-2 microprocessor

17. Support the CH-53 application software development, execution and test

18. Support the CNI simulation and subsystem software development installation and test

19. Support the Navigation simulation and subsystem software development, installation and test

The System Software Engineer in the performance of these tasks may direct or guide engineers and other technicians assigned to him. He shall:

1. Be responsible for the quality of output of those he directs and accomplishment of tasks on schedule and within the budget assigned.
2. Keep the Project Director informed of current status and anticipated problems.
3. Provide monthly progress reports stating past month accomplishments and those planned for the following month.
4. Assist the Project Director in project planning and funding requirement estimates.
5. Provide delineation of IDWA tasks.
6. Provide determination of levels of efforts for tasks he proposes for BASIC in software or related areas

4.3 STAFFING PLAN

The BASIC program will employ people from its own project and from both the systems and the technology areas of NAVAIRDEVCEN. Personnel from the systems and technology areas will work for BASIC via an IDWA.

SECTION 5
OVERVIEW

5.1 GENERAL DESCRIPTION

The name of the BASIC Laboratory — Basic Avionic System Integration Concept — is also a concise description of its mission. The integration of avionic systems within the framework of the 1553B multiplex bus architecture is the common denominator of the diverse projects in the BASIC Laboratory. The projects in BASIC fall into three types of activities: development and maintenance of the BASIC Laboratory facility; evaluation of technologies; and platform program support. The laboratory development activity is described below and in Section 6.2. The other activities are discussed in Section 5.2 with details in the appendices.

5.1.1 Laboratory Development

The laboratory development includes all development, operation, and maintenance activities in the BASIC Laboratory. The laboratory development includes the evolution and addition of hardware and software facilities within the framework of the BASIC Architecture Plan (Ref. Report No. NADC-79161-40, dated 17 May 1979). The operation and maintenance efforts are those necessary each year to keep the BASIC Laboratory an efficient and effective operating facility.

The operation and maintenance activities include management of all aspects of the laboratory, maintenance of the hardware and software aspects of the laboratory by acquiring spare parts, repair of parts, and repair and support services. Also part of these activities is the production of documents, including management plans, progress reports, IDWA's, funding plans, and work proposals.

The development activities involve hardware acquisition and software development to achieve the generalized avionics system characteristics spelled out in the BASIC Architecture Plan (Ref. Report No. NADC-79161-40, dated 17 May 1979). These characteristics define an advanced distributed processing architecture built

around use of the MIL-STD-1553 multiplex data bus. The main purpose of this architecture is the establishment of a generic avionic system with a core of capabilities to:

1. Support a full complement of avionics subsystems
2. Provide abilities to run missions for system test and evaluation
3. Generate data to simulate realistic environmental conditions and sensor inputs

In addition to having these capabilities, the BASIC laboratory plans to achieve sufficient flexibility to evaluate technologies and to support platform programs in a more cost effective manner than specialized prototype and "hot bench" laboratories.

5.2 INTRODUCTION TO BASIC LABORATORY SUPPORT TASKS

This section provides a brief description of each major work effort in progress and/or planned for the interval of this program plan (FY81-FY85). Each subsection serves as a background for, and an introduction to, a major task which is described in detail in the referenced appendices.

5.2.1 SPAM (Reference Appendix A)

The signal processing architecture methodology program (SPAM) has as its main objectives the production of standardized hardware and software interface specifications for military signal processing systems, a high order language (HOL) development and evaluation environment, and a set of benchmark experiments for realistic test and evaluation of acquired and/or developed signal processing subsystems. Work towards these objectives will also produce a set of functional packages, called MACRO's, each of which will satisfy a specified subset of the processing requirements of an avionics subsystem. These MACRO's will be produced for both signal processing (SP) and non-SP portions of avionics subsystems to constitute a library whose purpose is to provide software development support of avionics systems. The library of MACRO's will be the end product of a series of survey, review, design and development, and test and evaluation tasks. The MACRO library is one of the major elements of the HOL development and evaluation environment mentioned above. The library will also include the HOL compiler, program development and debug facilities, the test and evaluation support tools which include the benchmark programs, and the operating system around which all the other capabilities are built.

5.2.2 TACAMO — EC(X) (Reference Appendix B)

TACAMO is a manned airborne communication platform. Through its communication facilities the National Command Authority sends messages to the globally dispersed Fleet Ballistic Missile Submarine Force. Since its initial deployment, TACAMO's capabilities have been improved and expanded in an evolutionary manner to produce the currently operational system of extremely high effectiveness and reliability. The evolution of the current system has caused great increases in terms of total equipment, cabling, and crew. The increases of equipment have also posed problems in terms of interconnections between crew stations and the communications equipment and in certain aspects of overall system reliability. Introduction of the MIL-STD-1553B multiplex bus to the new platform proposed for the next generation TACAMO implementation provides solutions to interconnection and reliability difficulties, improves system flexibility to enhance the opportunities for further system update and improvement, and moves TACAMO towards the multiplex bus architecture specified as the goal for future military air platforms.

BASIC is supporting the transition stages of TACAMO between the current generation and the next generation in a new platform. These phases of transition involve interfacing TACAMO avionics equipment with the 1553B multiplex bus in the BASIC laboratory. Test and evaluation experiments can lead to design changes in the system architecture and equipment for the new generation TACAMO. Equipment built according to the new designs can be subject to further test and evaluation by BASIC to qualify for flight testing in the new TACAMO aircraft.

5.2.3 AAAS/A^2I^2 Support (Reference Appendix C)

The Navy has established the Advanced Aircraft Armament Systems (AAAS) development and a joint Navy/Air Force Aircraft Armament Interoperability Interface (A^2I^2) agreement to improve multi-service interoperability. Within the context of providing technical services to NWC to perform review of and inputs to the AAAS and A^2I^2 programs, BASIC is planning contributions in two areas: evaluation of languages and multiplex data word/data message (DW/DM) standardization analysis and study.

The evaluation of languages will consider several high order languages now in use in military systems and in industry. Also to be reviewed in this study is the high order language, ADA, which is in advanced development under the sponsorship of the high order language work group (HOLWG) of DOD. Language features will be investigated and compared. The requirements imposed upon high order languages by typical avionics applications will be analyzed and cataloged. These requirements will be cross-checked against the language features to assess which language satisfies which requirements. A summary analysis will be written for each language in the study.

The data word/data message standardization analysis and study will be comprised of several major phases.

1. Examination of data flows and multiplex bus messages in existing systems
2. Derivation of guidelines for standardization
3. Analysis of the impact of proposed standards on hardware, software, and system architecture
4. Presentation of interim and final reviews and reports with conclusions and recommendations

5.2.4 HIS Support (Reference Appendix D)

The BASIC laboratory support of the helicopter integration system (HIS) project consists of three tasks. The first is the integration of HIS avionics into the BASIC laboratory configuration. The second task entails the production of special purpose integration software for support of the integration of HIS into BASIC. The third task involves support responsibilities for BASIC laboratory operation and maintenance and to HIS for the test and evaluation efforts in the BASIC laboratory.

5.2.5 VRS Support (Reference Appendix E)

The main objective of the voice recognition and synthesis (VRS) support efforts of BASIC is to develop a system configuration to enable experimentation with VRS technology in a generalized avionics system whose architecture is designed around the 1553B multiplex bus. The elements of this configuration are:

1. A data link connection between the NOVA computer in the AIDS laboratory and the ACTRON remote terminal in BASIC
2. A switching unit to interface between cockpit type headsets and the VRS system in AIDS and to permit voice input and output from either AIDS or BASIC (or both)
3. Avionics equipment to receive digitized voice inputs, transmit information to be translated into control outputs, and provide synthesized voice outputs from specific data inputs.
4. Control, display, and simulation to provide bus and problem control, display of mission parameters during the performance of experiments, and simulation of avionics system characteristics to provide a "real-world" data flow for voice experiments.

5.2.6 ASPC Support (Reference Appendix F)

The airborne sensor processing and correlation (ASPC) program has as its long range goals the application of correlation techniques to individual sensor systems to improve target localization and the development of association and correlation algorithms to refine these parameters by using inputs from multiple sensor systems. The BASIC laboratory will support the achievement of these objectives with the development of a host computer and the installation, validation, and demonstration of the MSC algorithms utilizing the host computer for the environment simulation.

5.2.6.1 Sensor Simulations

Sensor simulation software will be installed in the BASIC laboratory to provide sensor data for ASPC experiments in three categories:

1. RADAR
2. Acoustic Sonobuoys
3. ESM

5.2.6.2 Scenario/Mission Control Software

Scenario/mission control software will provide a context for mission simulations including position and course data of targets and ASW planes, environmental data, a time base for running the mission, and a man/machine interface to alter mission conditions and to monitor system performance.

5.2.6.3 Correlation Software

The following are two types of correlation software:

1. Correlation software using single sensor data to improve the estimation of target parameters
2. Correlation software using multiplex sensor data to improve target detection sensitivity and to refine target parameters for detected targets

5.2.7 F-14 Support (Reference Appendix G)

The F-14 support efforts planned in the BASIC laboratory are divided into four groups of tasks:

1. Conversion in lieu of procurement (CILOP)
2. Multisensor correlation (MSC)
3. Voice interactive systems (VIS)
4. Application of fiber optics bus technology to an avionics system (avioptics).

Each group of tasks is discussed in a separate paragraph below.

5.2.7.1 F-14 CILOP Support

The F-14 CILOP program will produce an advanced version of the F-14 with the capabilities to satisfy proposed mission requirements through the 1980's and into the 1990's. During concept validation, BASIC will provide support with technical reports and with reviews of in-house and contracted work and by studying and evaluating interface problems. During preparation for DSARC II, BASIC will perform system design and review services, conduct laboratory test and evaluation experiments and demonstrations, and participate in monitoring and reporting on other work in progress. In support of the F-14 CILOP development and validation (D&V), BASIC will engage in software support planning, subsystem performance verification, and in defining interface requirements. BASIC will contribute to the preparation of the test and evaluation master plans (TEMP's) both in the updates and final versions; in the area of development test and evaluation (DT&E) planning; in participation in integration studies; and in review and evaluation of such topics as risk assessment, critical integration issues, and subsystem traceability.

5.2.7.2 F-14 MSC

The F-14 multisensor correlation (MSC) efforts in the BASIC laboratory are aimed at establishing MSC capabilities applicable to F-14 missions operational in BASIC. The first phase will consist of configuration definition, hardware and

software design and implementation, and system integration. The development, test and evaluation (DT&E) phase will refine the results of the integration efforts to support F-14 MSC experiments in the BASIC laboratory's general avionics configuration.

5.2.7.3 VIS

The BASIC laboratory will contribute to the F-14 voice interactive systems (VIS) requirements evaluations by performing the following tasks:

1. Implementation of a defined F-14A vocabulary into a voice recognition module
2. Implement and demonstrate voice commands based on this vocabulary
3. Conduct experiments to compare keyboard command inputs with voice inputs
4. Demonstrate synthesized voice alerts of critical plane and mission parameters
5. Conduct experiments comparing the effectiveness of voiced alerts to the air crew with the traditional cockpit alerts of displays, flashing lights, and audible alarms.

5.2.7.4 Avioptics

The F-14 CILOP configuration shall serve as a guide for the design and development of a fiber optics multiplex bus application for an avionics system (avioptics). The first phase of this work includes a study of military and commercial fiber optics bus applications leading to a technical report on the state-of-the-art of fiber optics buses. The second phase will consist of the design and implementation of a fiber optics data bus suitable for the requirements of the target system (F-14 CILOP) and its integration with avionics equipments. The test and evaluation in this environment will lead to refinements and further testing in order to produce a comprehensive technical report on the applicability of this technology to the F-14 CILOP.

5.2.8 AGS Support (Reference Appendix H)

The Acoustic Generation System (AGS) provides acoustic research and development services for the support of platform projects and for the enhancement of advanced technology programs involving acoustic sensor equipment. The development of the AGS combines the laboratory assets of three distinct technology laboratories with a set of unique acoustic generator hardware. The BASIC Avionics System Integration Concept (BASIC) laboratory, the Advanced Antisubmarine Warfare Processing Techniques (ADAPT) Laboratory, and the Advanced Integrated Displays Systems (AIDS) Laboratory will contribute major elements which will interface with acoustic generator and control subsystems to form the total AGS configuration.

The BASIC laboratory will interface the DEC VAX 11/780 into the AGS. The VAX 11/780 will be the host data processor of the AGS. The host functions include problem control, input and control of environmental and tactical parameters, and the geometry aspects of target, sensor, and ASW plane positioning during simulations.

5.2.9 Support for GPS User Equipment/Host System Integration (Reference Appendix I)

5.2.9.1 GPS Program Description

Navstar GPS is a tri-service program for developing a space-based radio positioning navigation system that will provide extremely accurate three-dimensional position and velocity information, together with system timing, to any suitably equipped user anywhere on or near the earth. The Navstar GPS comprises three segments: Space (satellites), Control (satellite tracking and control), and User (navigation receiving sets). This BASIC support plan is concerned only with the User Segment.

The Navstar GPS program has completed Concept Formulation and Phase I, Concept Validation, and is currently in Phase II, Full-Scale Engineering Development.

Phase II, Full-Scale Engineering Development, began in June 1979 after DSARC II and is scheduled to be completed in September 1983. This phase will provide for the generation of preproduction prototype sets, which will undergo TECHEVAL and OPEVAL on Navy and other service platforms. Phase II is being accomplished in two stages, IIA and IIB. Phase IIA was a 12-month predesign study effort initiated near the end of Phase I. Phase IIB consists of design, fabrication, and test of the prototype sets. Specific classes of User Equipment will be prototyped and tested, on the basis of the requirements generated by each service.

Phase III, Production, is scheduled to begin in September 1983 after DSARC III. This phase is to provide for the generation of production units of the GPS User Equipment.

The User Equipment DT&E program to be conducted during Phase IIB will consist of four parts:

1. In-Plant Tests — To verify nuclear hardness, measure functional performance, verify interoperability with support equipment, gather reliability data, demonstrate maintainability, verify software design, and measure performance under jamming conditions.
2. Vehicle Mod Center Tests — To verify that the User Equipment will perform satisfactorily in the test Host Vehicles, verify safety of flight and EMC, and establish that the User Equipment is ready for flight tests.
3. Field DT&E — To be accomplished aboard a C-141 and M-35 truck to verify static and dynamic performance of palletized User Equipment and to evaluate hot mockups of interfaces between palletized User Equipment and Host Vehicle systems.
4. Operational Readiness Tests — To be conducted with GPS User Equipment installed in actual Host Vehicles to verify system performance under a variety of operational and environmental conditions, and to confirm that the User Equipment is ready for OPEVAL.

5.2.9.2 BASIC Support

Appendix I presents preliminary plans for the NAVAIRDEVCEN BASIC Integration Laboratory's support of the GPS User Equipment Integration Test Program. The primary objective of the BASIC/GPS testing is to augment and supplement the achievement of Approval for Service Use (ASU) of GPS User Equipment in advanced Navy aircraft systems (LAMPS MK III, F-18, etc.). This objective can be achieved by using the BASIC laboratory facility and its experienced personnel to gather test data that will resolve potential technical issues related to interfacing the GPS User Equipment with Navy aircraft systems that employ the 1553 data bus.

Another objective of the BASIC GPS test program is to determine the impact of host system dependency on the 1553 module and to gather data that will support approaches for achieving commonality to resolve this potential problem.

5.3 TOP LEVEL WBS

The top level work breakdown structure for the BASIC project is shown in Figure 5-1.

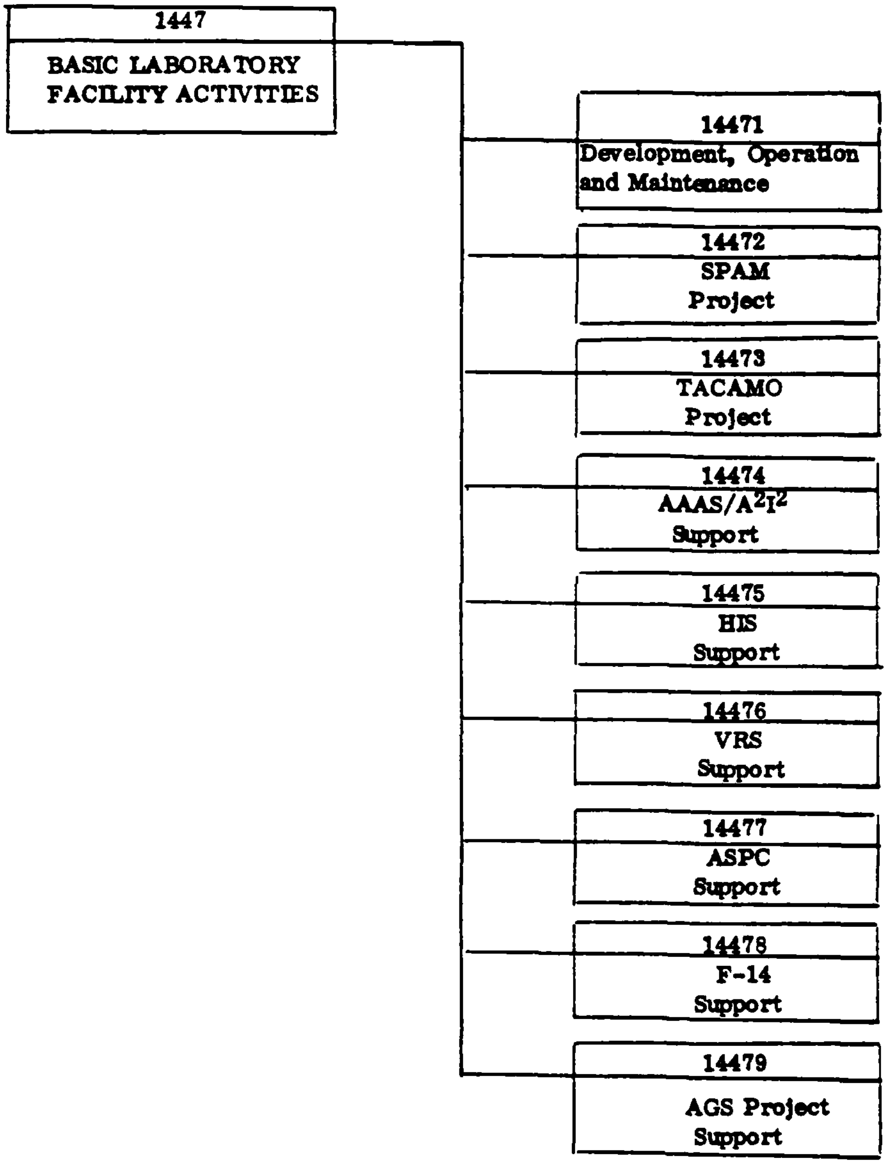

Figure 5-1. BASIC Laboratory Top Level Work Breakdown Structure

SECTION 6

BASIC LABORATORY TASK DESCRIPTIONS

6.1 TASK DESCRIPTIONS

This section and the appendices contain detailed information on the currently active and/or planned tasks for the BASIC Laboratory. Each task is represented by a descriptive section with a work breakdown structure (WBS) diagram and a milestone schedule. Funding and manpower requirements are also shown.

6.2 BASIC LABORATORY DEVELOPMENT, OPERATION, AND MAINTENANCE

This section provides information on the development, operation, and maintenance of the BASIC Laboratory during fiscal years 1981 through 1985. The development aspects include hardware and software elements to increase the laboratory's capabilities to fulfill the generic avionics missions described in the BASIC Laboratory Architecture Plan. The operation and maintenance aspects are those efforts involved with the continuing operation of the laboratory in support of technology evaluation and platform development projects. Figure 6-1 shows the overall work breakdown structure (WBS) for BASIC Laboratory development, operation, and maintenance.

6.2.1 Description

The descriptive material in this section is organized into two major subsections. The general aspects of laboratory development, operation, and maintenance are covered in 6.2.1.1, and the major elements of laboratory development are covered in several paragraphs organized under 6.2.1.2.

6.2.1.1 General Development, Operation, and Maintenance

This portion of the BASIC activities description covers the day-to-day operation and maintenance of the laboratory and general development aspects. The latter portion of the activities includes development efforts not included

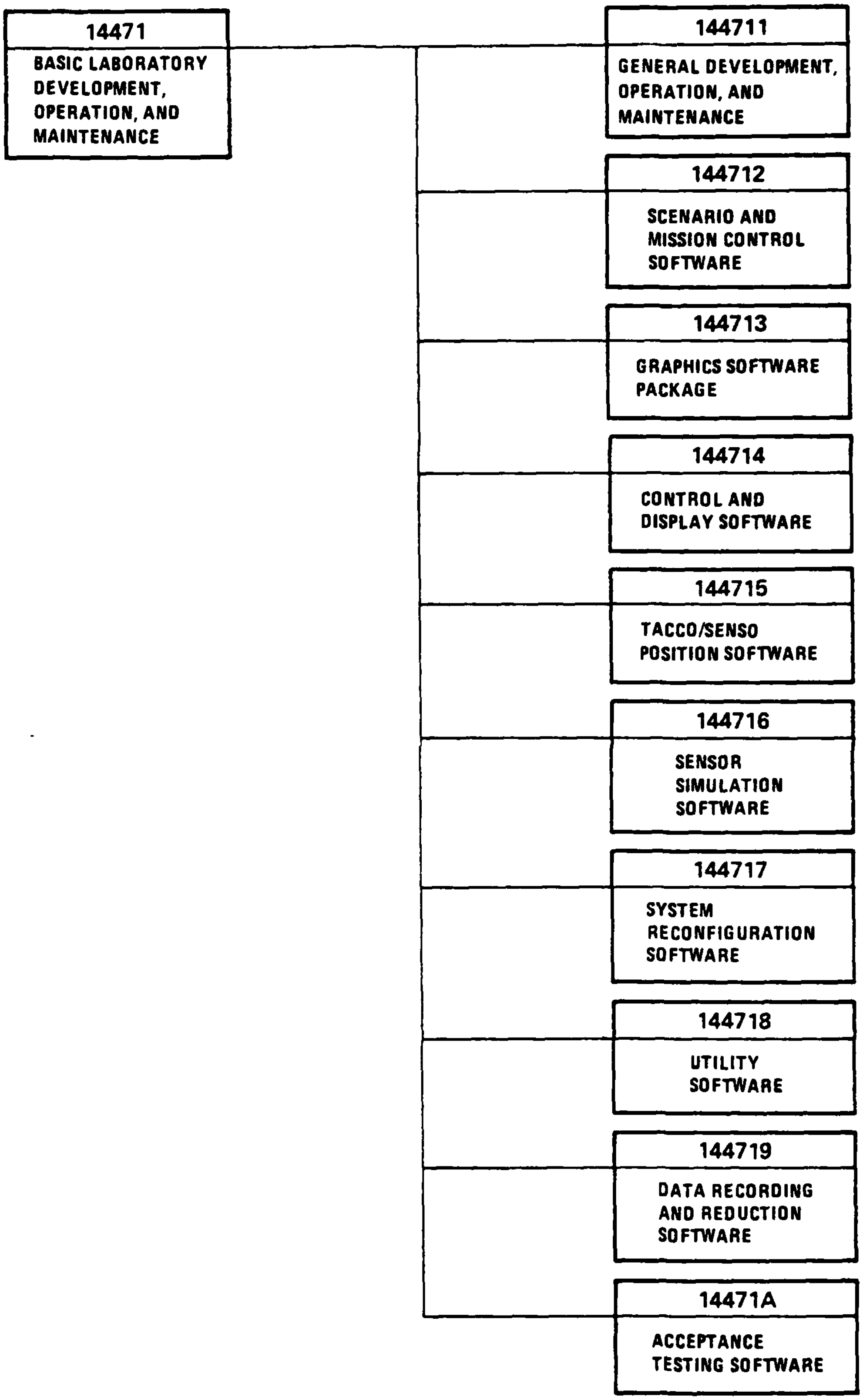

Figure 6-1. BASIC Laboratory Development, Operation, and Maintenance Work Breakdown Structure

under specific headings in 6.2.1.2. The procurement of all new hardware is included, as well as the necessary spare parts and maintenance services. As shown in Figure 6-2, the general development activities are combined with the operation and maintenance activities for better management control and coordination with the operation and maintenance activities. The WBS shown in Figure 6-2 represents the general development operation and maintenance efforts in the standard NAVAIRDEVCEN WBS organization and terminology.

6.2.1.1.1 Project Management. This portion of the BASIC WBS covers management activities dedicated to the BASIC laboratory implementation as well as those of evaluating technologies and supporting avionics platform programs. Included are the management responsibilities of developing, operating, and maintaining the BASIC facility. This part of the WBS also includes those activities which are dedicated to managing specific platform support or technology evaluation programs. General planning and scheduling as well as procurement support are covered. Also included are status reporting, progress reports, and periodic reports on the various test and evaluation activities.

6.2.1.1.2 Spares/Repair Parts and Services.

This portion of the BASIC Laboratory WBS covers the procurement of spares, repair parts, and services for the computing equipment in the laboratory. The computers to be supported are the DEC VAX 11/780, the AN/AYK-14 Standard Avionics Computers, and the Cromemco Z-2 Microcomputers. The spares and repair parts acquired shall be sufficient to ensure operability of the laboratory computers. The repair services shall include appropriate preventive maintenance services and provision for corrective maintenance services as required.

6.2.1.2 BASIC Laboratory Development

This section of the BASIC WBS covers those activities which will develop the BASIC laboratory facilities from the core implementation described in the October 1979 Progress Report to the full implementation of the BASIC Architecture Plan. In the process of this implementation, BASIC will evolve from

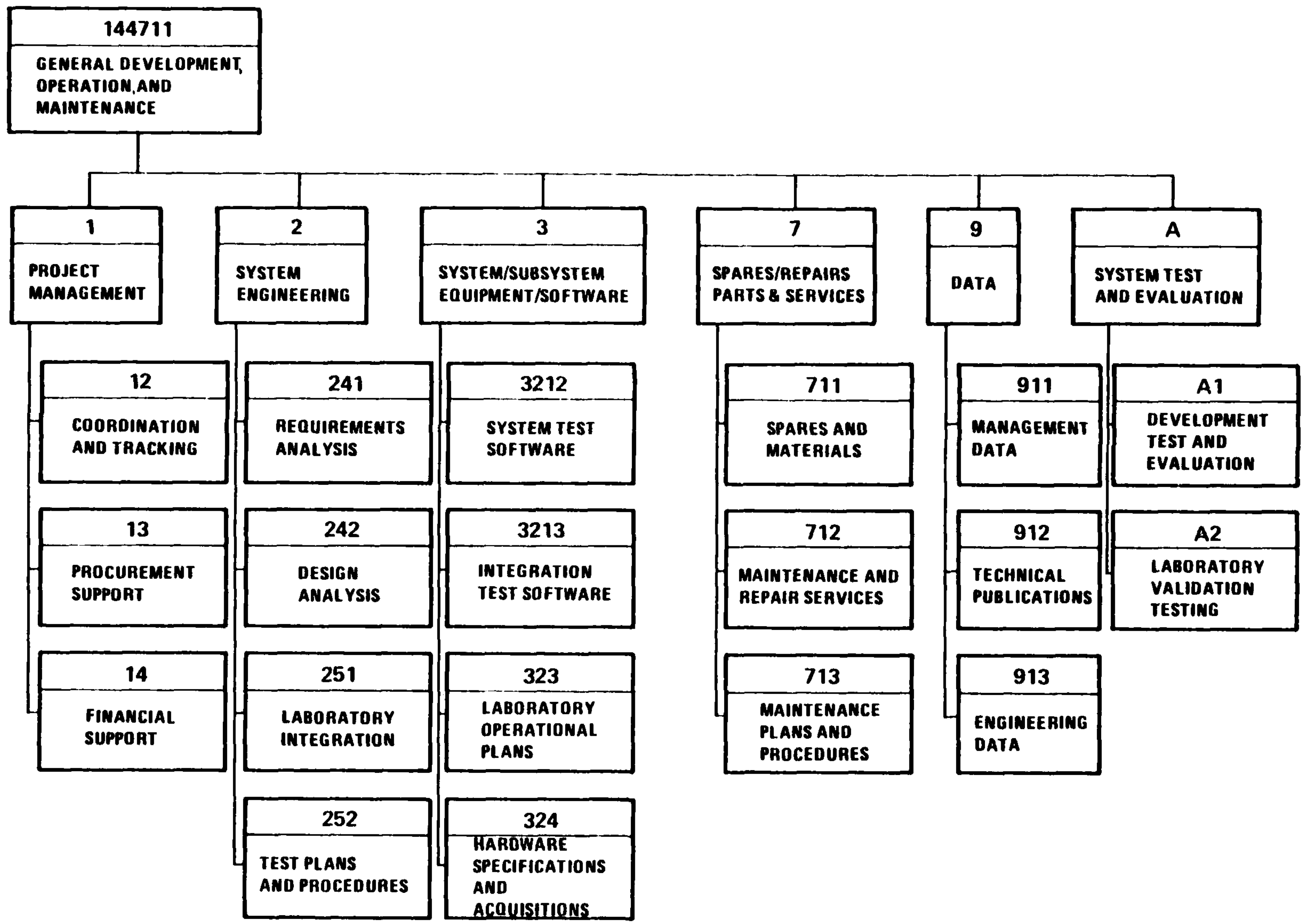

Figure 6-2. Work Breakdown Structure for General Development, Operation, and Maintenance

the engineering development phase to operational and maintenance status. In order to provide better understanding and management visibility of the implementation plan, each major component is contained in a separate WBS subsection. These major components are described in the following paragraphs.

6.2.1.2.1 Scenario and Mission Control Software. This section of the BASIC laboratory implementation concerns development of the scenario and mission control software. This element of software will run in the DEC VAX 11/780 computer and will provide information to the avionics system including plane course and speed, target positions, and mission characteristics, as well as environmental conditions such as wind, sea state, and electromagnetic background noise. Although this type of software has been developed in the BASIC laboratory, this task is defined as though it were a completely new activity to enable the Functional Specifications and the Program Performance Specifications to address the system as it will exist when the BASIC laboratory architecture is fully implemented. The design for the full architectural implementation will provide a context for the implementation phase that will allow use of existing software, where feasible. A modular, table-driven software design will furnish the capabilities necessary for the eventual BASIC implementation and will be flexible enough to be used by the BASIC laboratory during the intermediate steps of hardware and software growth. The work breakdown structure is shown in Figure 6-3 and the milestone schedule is shown in Figure 6-4.

6.2.1.2.2 Graphics Software Package. The efforts of this portion of the BASIC laboratory implementation are directed toward acquiring a graphics software package. This package will supply the basis for producing graphic displays for avionics applications on the graphic display and printer equipment in the laboratory. This acquisition will support the production of displays for the general avionics functions of TACCO, SENSO, communications, navigation, and system status.

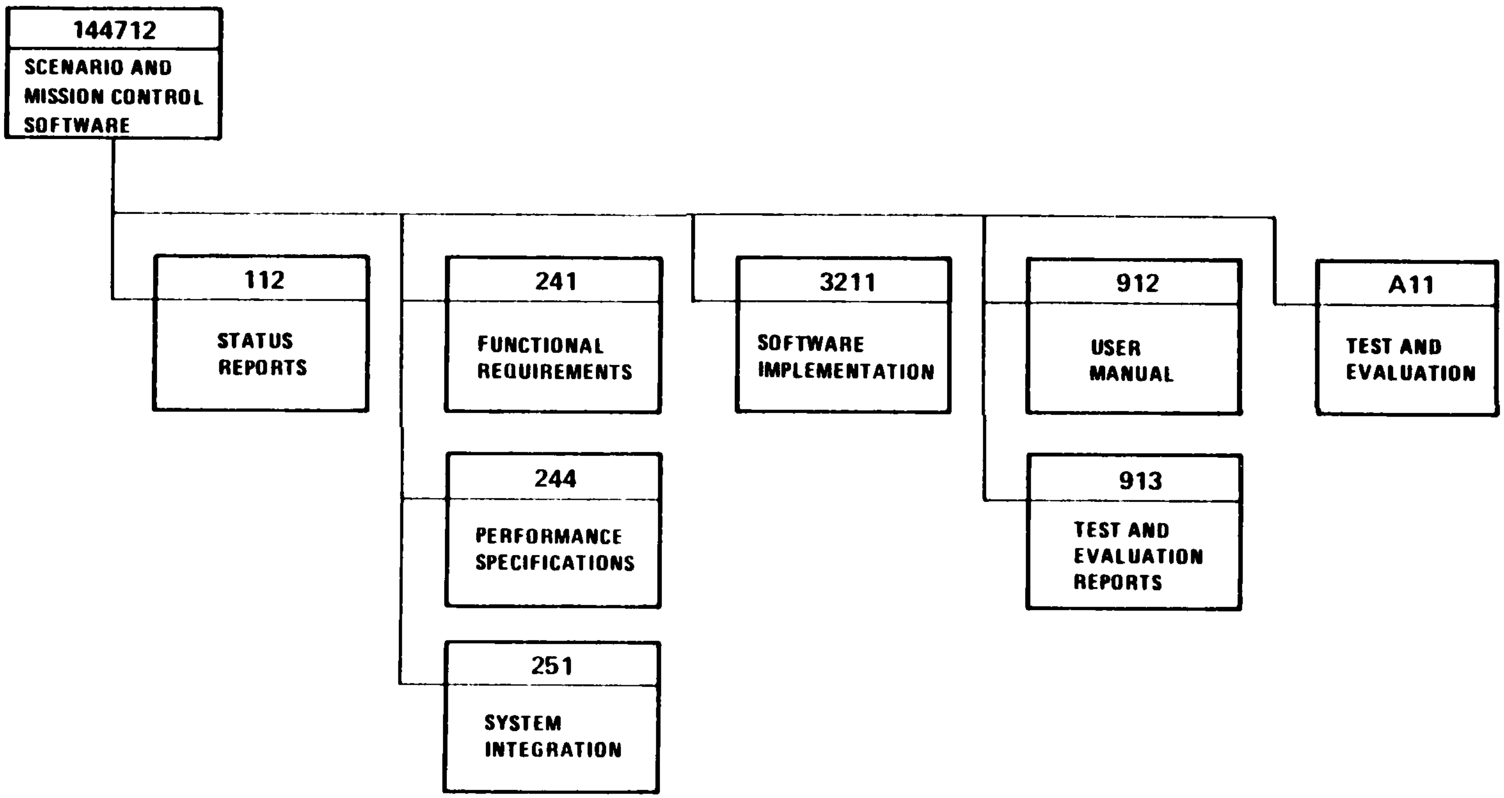

Figure 6-3. Work Breakdown Structure for Scenario and Mission Control Software

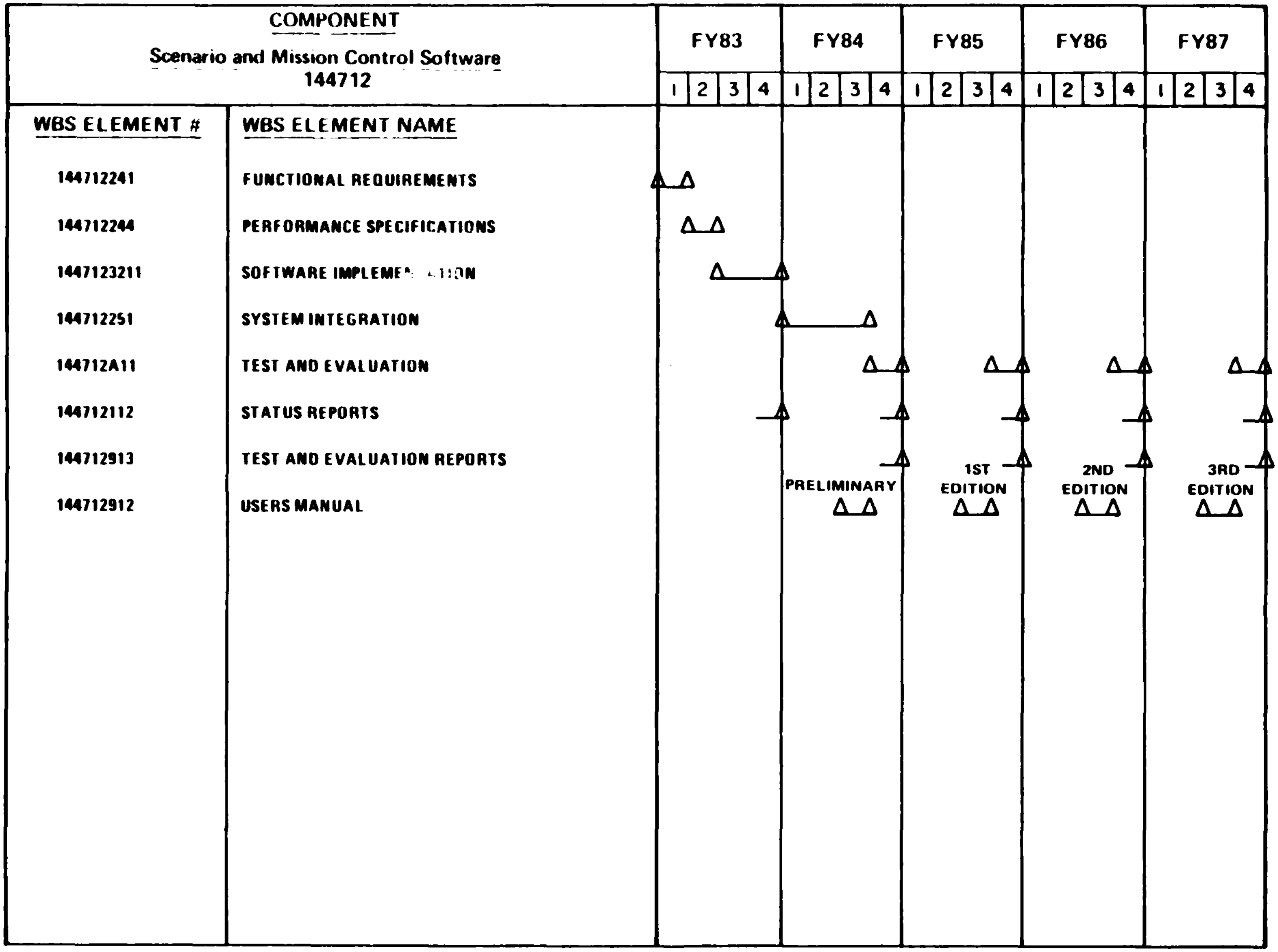

Figure 6-4. Milestone Schedule for Scenario and Mission Control Software

The package will be flexible enough to permit addition of new display equipment or reconfiguration of the system buses with minimum changes necessary to the software.

The graphics software package will furnish the core of all future display efforts in BASIC. It will support standard avionics displays for BASIC platform responsibilities, experimental displays for human factors technology tasks, and instrumentation displays for evaluation or measuring in the BASIC laboratory. The work breakdown structure is shown in Figure 6-5 and the milestone schedule is shown in Figure 6-6.

6.2.1.2.3 Control and Display Software. The control and display software to be developed in the BASIC laboratory will perform functions of data management and input/output control. These functions will operate on the display bus and the display control bus. According to the terminology of the BASIC Architecture Plan, the software will reside in display nodes S1 and S2.

The work to be undertaken in this portion of the BASIC laboratory development effort includes producing Functional Requirements, Program Performance Specifications, and Program Implementation. Also included are system integration efforts, including a task to write special system integration software. Test and evaluation and documentation efforts will continue on this major software component throughout the years of BASIC laboratory development. The work breakdown structure is shown in Figure 6-7 and the milestone schedule is shown in Figure 6-8.

6.2.1.2.4 TACCO SENSO Position Software. The TACCO/SENSO position software efforts will produce a coherent package to support the existing and future TACCO/SENSO display equipment in the BASIC laboratory environment. Existing software in the BASIC laboratory will be used as the basis for the larger, generalized software package.

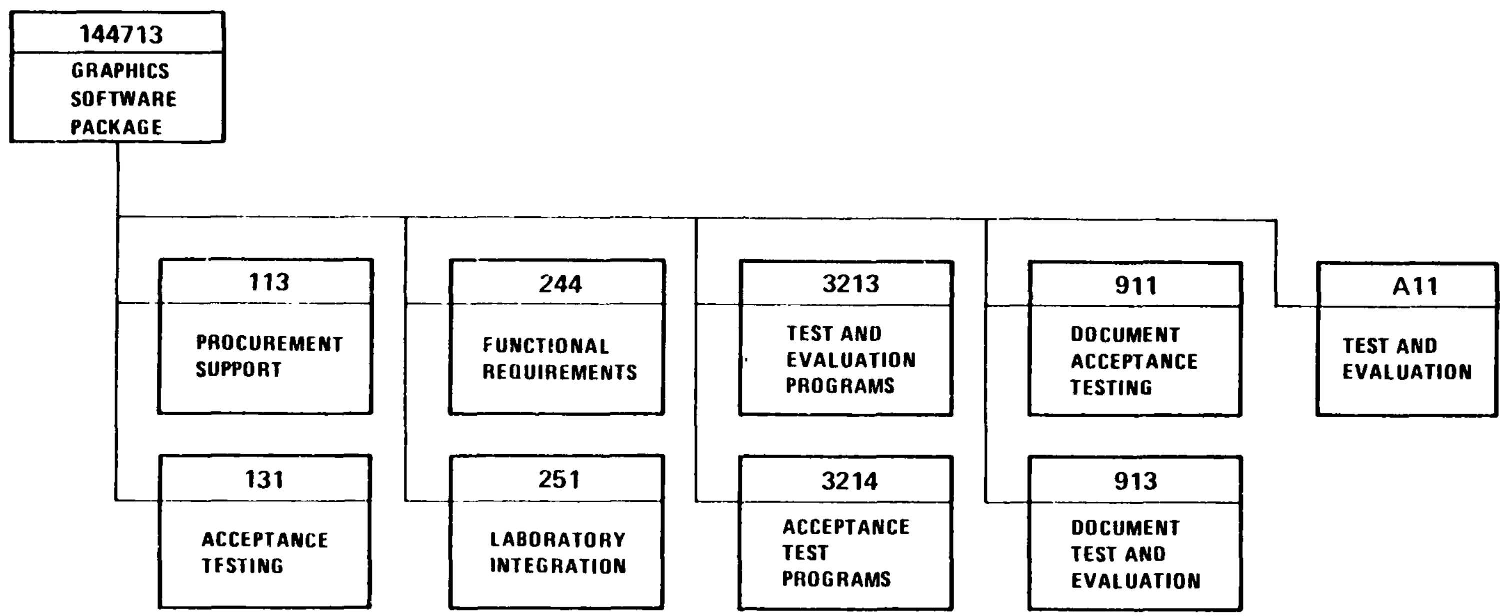

Figure 6-5. Work Breakdown Structure for Graphics Software Package

COMPONENT Graphics Software Package 144713		FY83				FY84				FY85				FY86				FY87			
WBS ELEMENT #	WBS ELEMENT NAME	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
144713241	FUNCTIONAL REQUIREMENTS	△	△																		
144713113	PROCUREMENT SUPPORT		△		△																
144713251	INSTALL IN BASIC LABORATORY				△		△														
144713214	ACCEPTANCE TEST PROGRAMS			△	△																
144713213	TEST AND EVALUATION PROGRAMS		△		△																
144713131	ACCEPTANCE TESTING				△	△															
144713A11	TEST AND EVALUATION					△		△													
144713911	DOCUMENT ACCEPTANCE TEST					△	△														
144713913	DOCUMENT TEST AND EVALUATION							△	△												

Figure 6-6. Milestone Schedule for Graphics Software Package

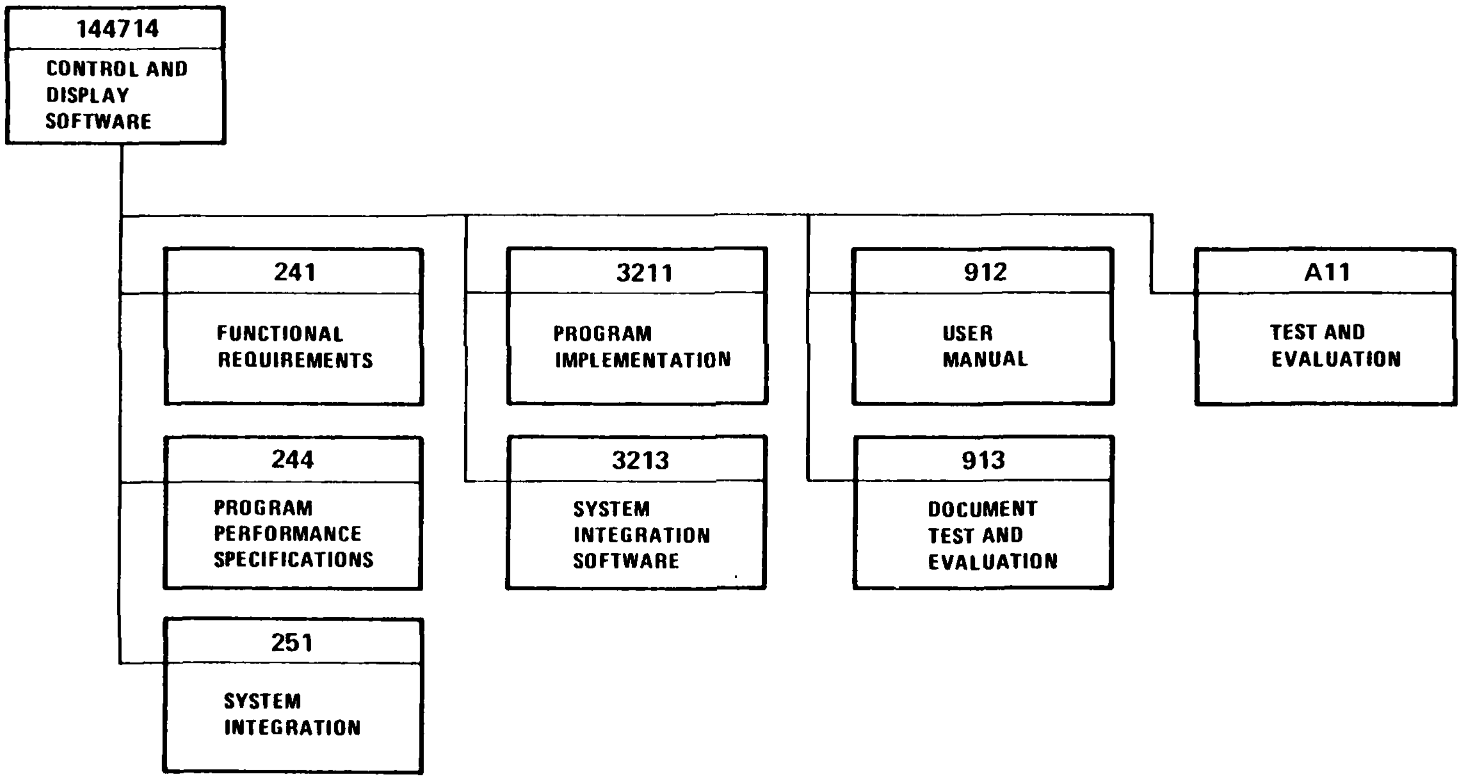

Figure 6-7. Work Breakdown Structure for Control and Display Software

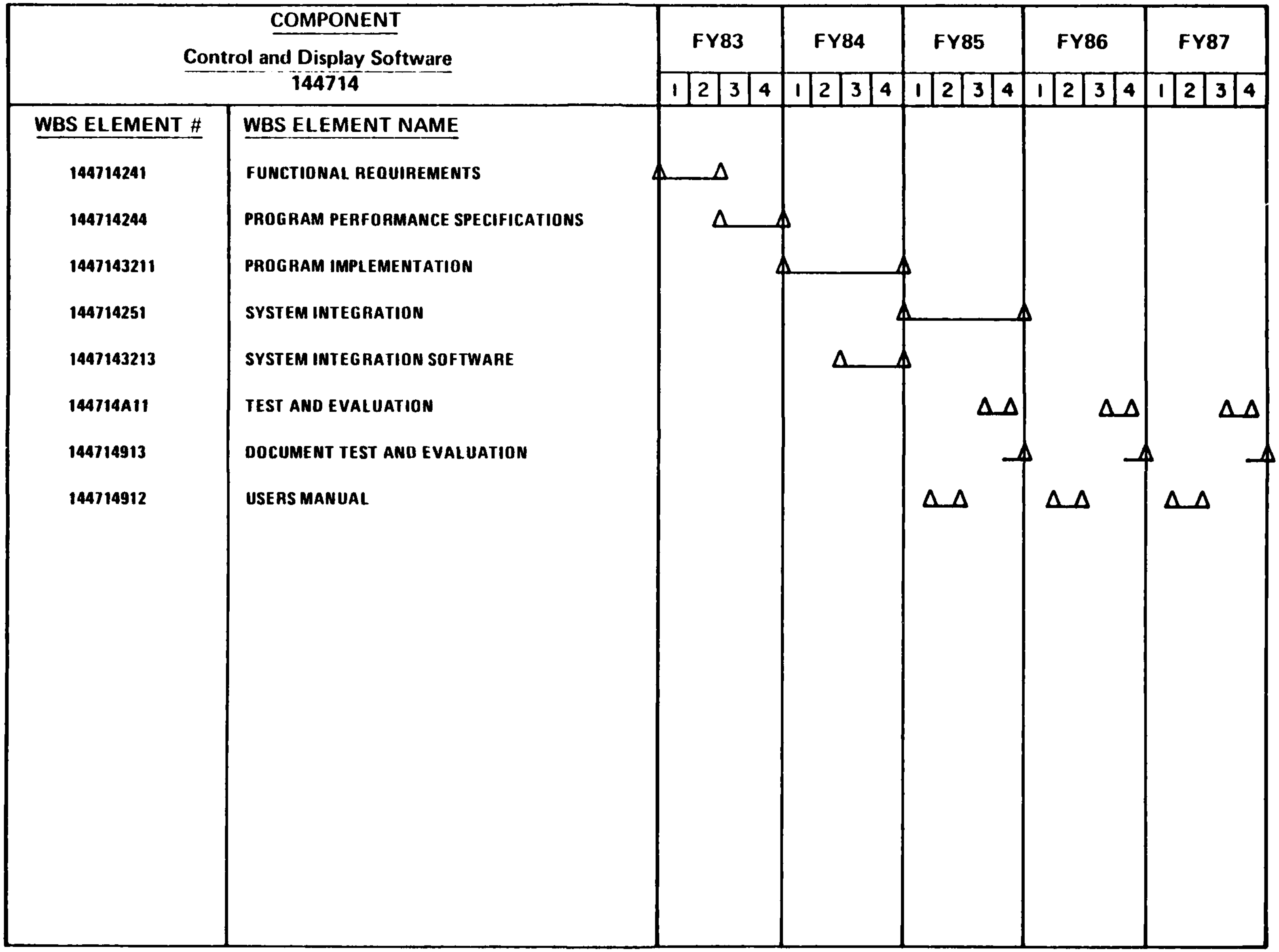

Figure 6-8. Milestone Schedule for Control and Display Software

The initial parts of this effort will produce the functional requirements (FR) and the program performance specifications (PPS). These documents will define the functions and describe the performance objectives of the TACCO/SENSO software package needed to support the TACCO/SENSO equipment planned for inclusion in the full BASIC laboratory architecture implementation. The package will be modular in structure to provide enough flexibility to accommodate additional display equipment of the same or different type without extensive programming modification. Production of the FR and PPS documents will draw heavily upon the experience gained in designing and implementing the TACCO/SENSO software now integrated in the BASIC laboratory. The FR and PPS documents will help the BASIC management plan the implementation phases to provide the most important functions on the existing equipment early in the development cycle. Other functions and support of new equipment will be implemented in later phases that are coordinated with equipment acquisition and with technology evaluation and platform support tasks planned or in process in the BASIC laboratory.

The activities of implementation, integration, test and evaluation, and documentation described in the work breakdown structure will occur in the several phases mentioned above. The phases of implementation and integration will provide incremental support in terms of functions and equipment towards the goal of supporting all functions and generalized equipment as spelled out in the FR and PPS documents. The test and evaluation activities will yield valuable information on the effectiveness of each stage of development and help to guide the development of the next stage. Documentation tasks will round out the implementation and test and evaluation segments. An important document planned for the TACCO/SENSO software effort will be the Platform User Guide. This user guide will help the manager of a platform program to evaluate the support that BASIC can offer his program in the TACCO/SENSO display area. The user guide will contain sufficient information to indicate how a new technology to be evaluated could be integrated and evaluated in the BASIC environment.

The work breakdown structure is shown in Figure 6-9 and the task and milestone schedule is shown in Figure 6-10.

6.2.1.2.5 Sensor Simulation Software. The sensor simulation software development includes all the software components that will provide simulated sensor data on the main avionics system bus. In the BASIC architecture plan, Figure 5-7 shows this as SYSTEM BUS (1). In the same figure, the logical components that will include the sensor simulation software are shown as the trapezoids labeled ESM, RADAR, FLIR, MAD, and ACOUSTIC SUBSYSTEM. Some of this type of software has been developed in the BASIC laboratory, much of it in the Z-2 microcomputers. This part of the BASIC laboratory development plan intends to build on the basis of the existing simulation software to produce a comprehensive collection of program elements that will satisfy the sensor simulation requirements of the completed BASIC laboratory architecture.

The functional requirements and the program performance specifications documents represent the results of the first stage of the planned efforts. These documents will constitute the blueprints for development of sensor simulation software. Concurrent with the production of the program performance specifications, but extending one quarter longer, will be an important effort to plan the implementation of the sensor simulation software in phases. These planned phases will be defined so that each phase consists of a clearly defined set of simulation capabilities and a carefully documented plan for implementation, test, and integration. This approach will provide management visibility of the progress and will give clearly described milestones to facilitate project tracking.

Special integration and test software will be written to provide realistic and rigorous conditions for the integration and testing of each phase of the implementation. Thorough test and evaluation will be conducted after the integration of each phase to access the effectiveness of the installed software and to furnish guidance for corrective and enhancement efforts in subsequent years. Thorough documentation of both the implementation and the test and evaluation tasks will

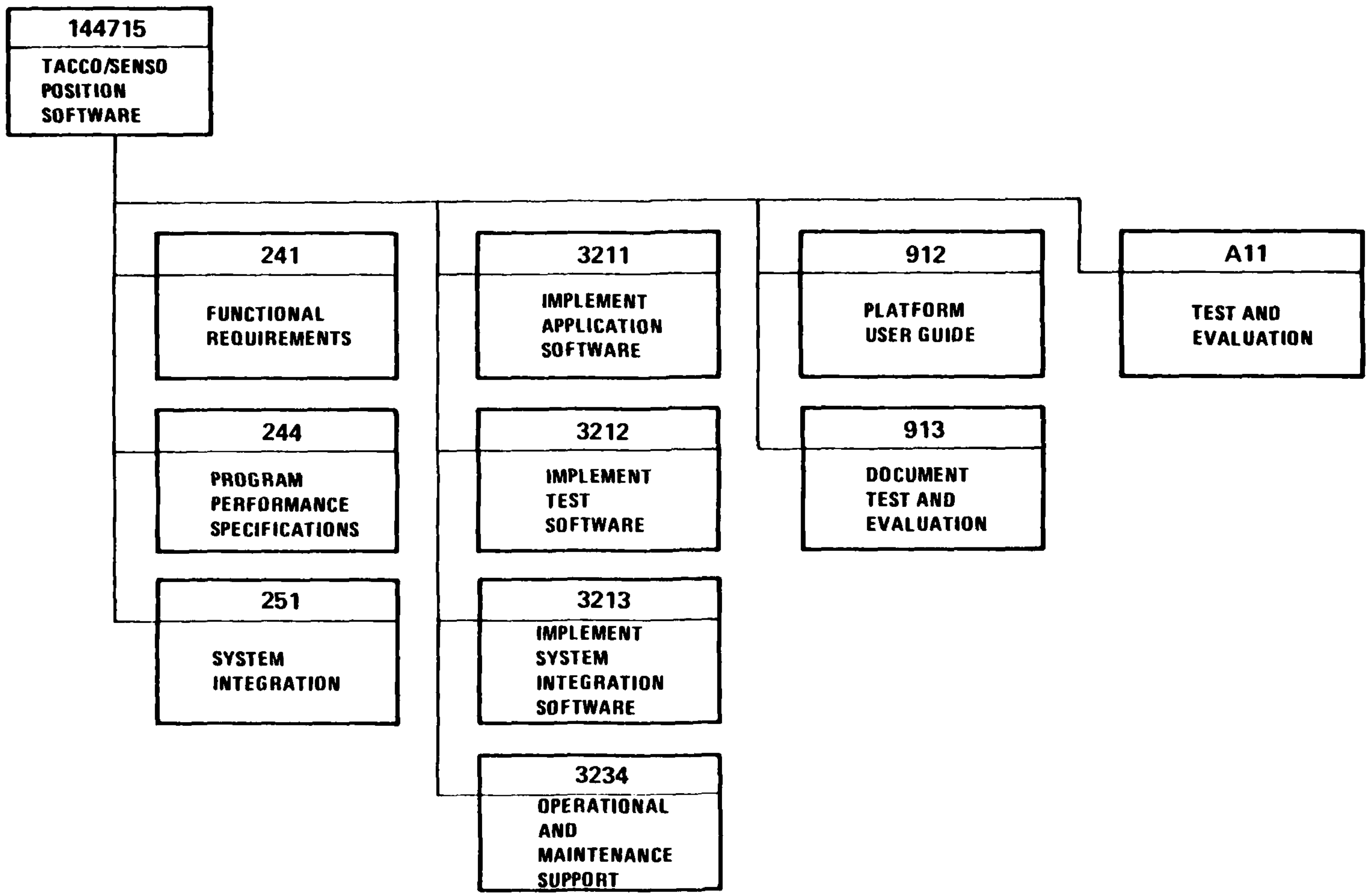

Figure 6-9. Work Breakdown Structure for TACCO/SENSO Position Software

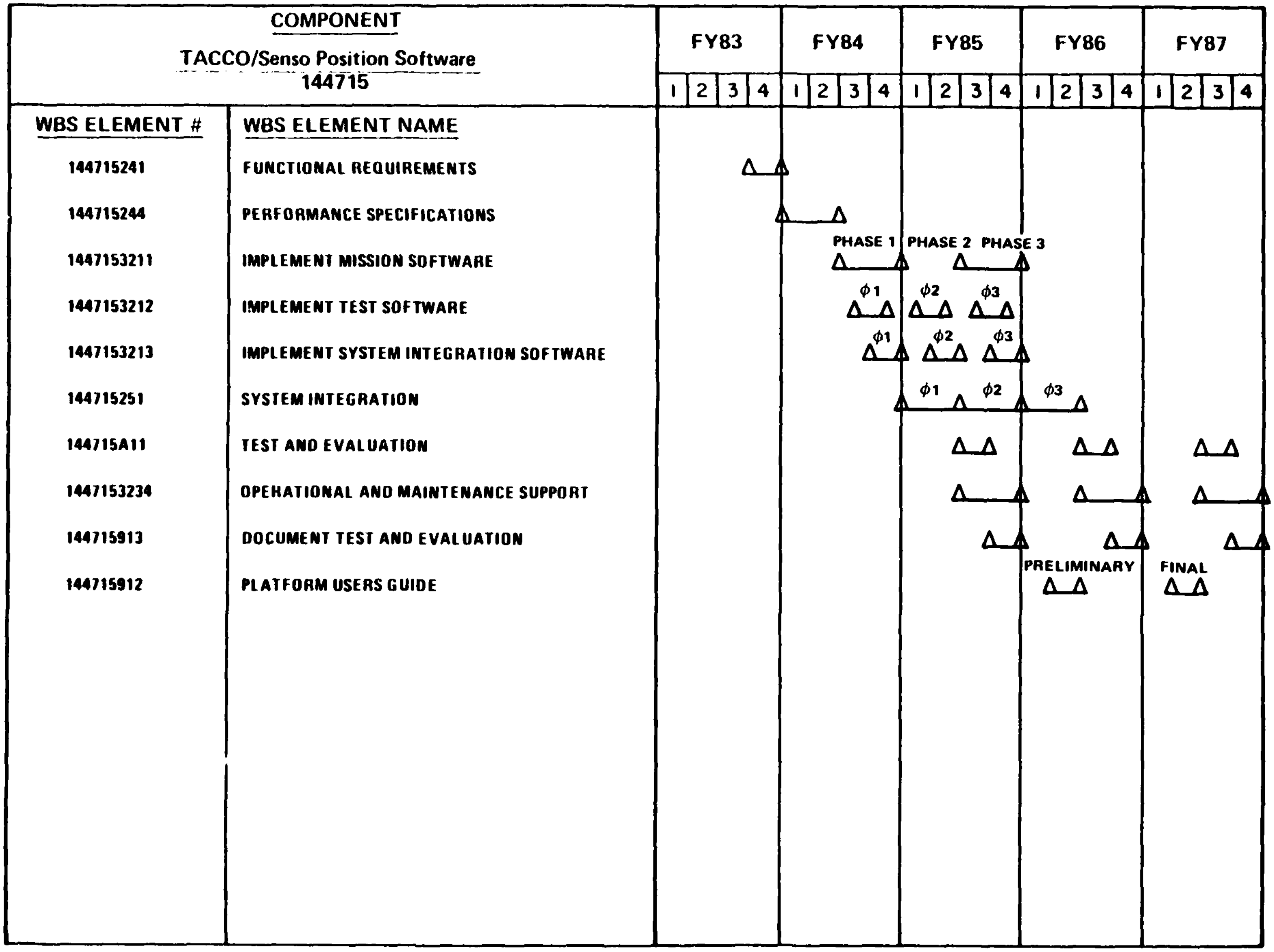

Figure 6-10. Milestone Schedule for TACCO/SENSO Position Software

solidify the accomplishments and facilitate maintenance and improvement activities. The production of a user guide will provide a valuable interface service to the BASIC laboratory. To BASIC, it will serve to make the simulation capabilities of the laboratory known to a larger potential user community. To the technology development or platform support manager, the user guide will offer a means of determining how BASIC sensor simulation capabilities can support and enhance his activities. In short, the user guide will make the results of the sensor simulation efforts available to the user community and will cultivate new clients for the BASIC laboratory. The work breakdown structure is shown in Figure 6-11. The task and milestone schedule is shown in Figure 6-12.

6.2.1.2.6 System Reconfiguration Software. The system reconfiguration software efforts encompass areas of critical importance to the development and operation of the BASIC laboratory. These areas are the vital categories of bus and node reconfiguration. The first category includes the software to detect bus failure and to switch multiplex bus communications to a secondary (or tertiary) bus. The second category includes the software to detect a node failure and to reconfigure the operational nodes in a manner that will facilitate the optimal level of performance with the resources available.

An important phase of the system reconfiguration software effort is the production of functional requirements and performance specifications. It is understood that a great deal of work has been accomplished in the area of system reconfiguration software, and that work is in progress in the BASIC laboratory to extend and improve this software. The intention is to produce documents that will represent the functions and performance objectives of the system reconfiguration software in the full BASIC laboratory architecture configuration. These documents will serve to determine long-range development goals and to act as a guide in establishing intermediate milestones during the years of the BASIC laboratory development.

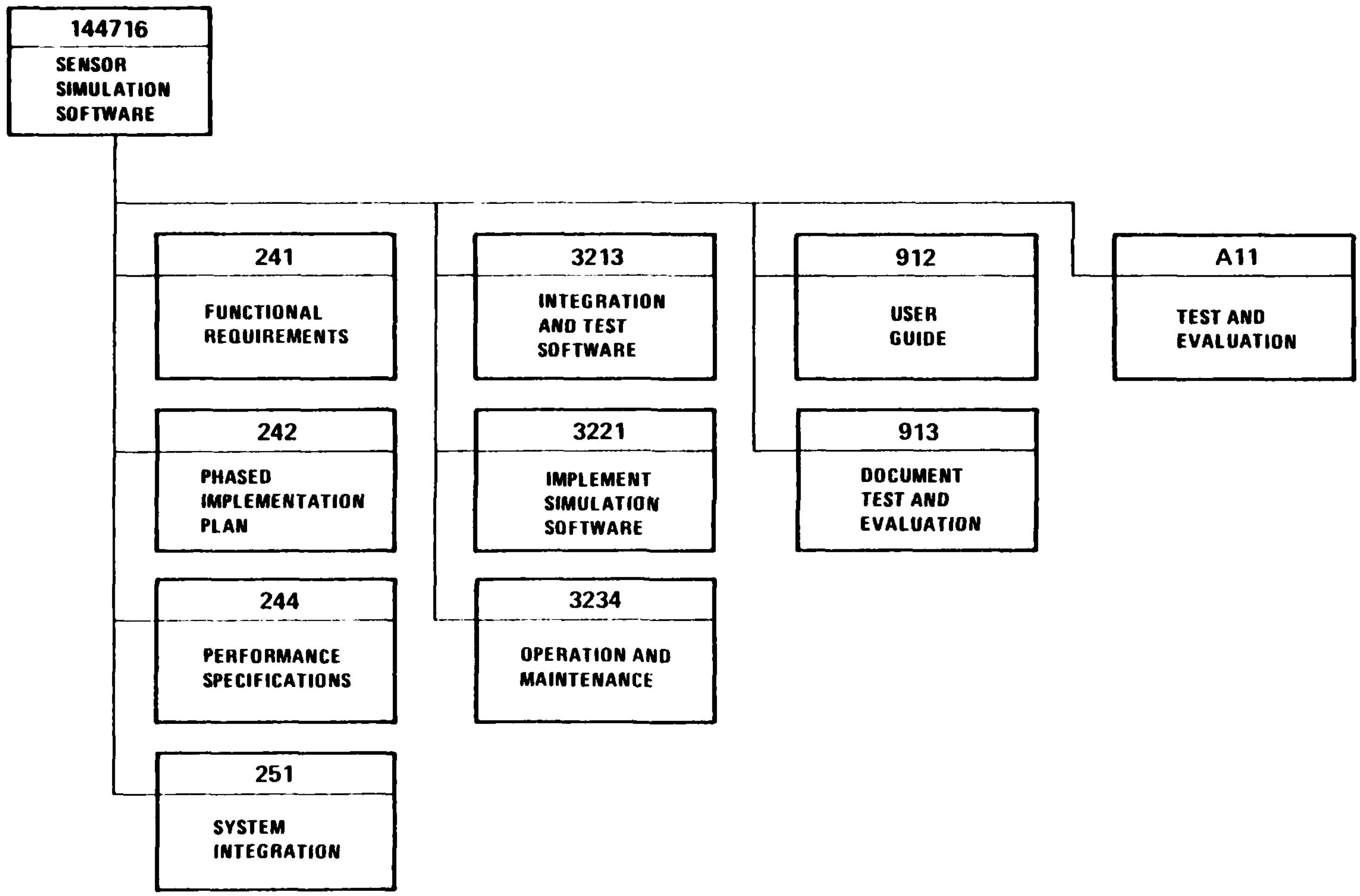

Figure 6-11. Work Breakdown Structure for Sensor Simulation Software

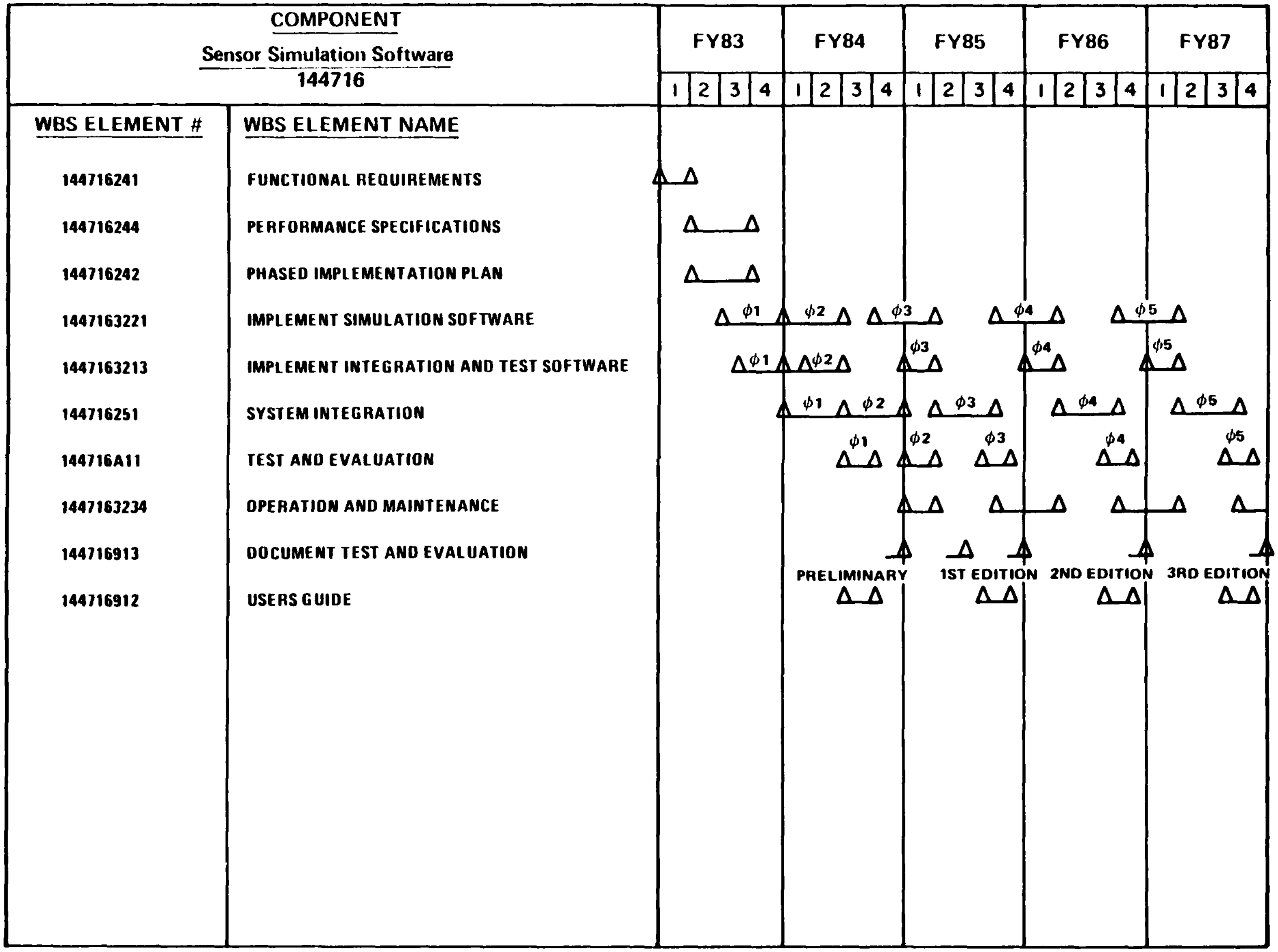

Figure 6-12. Milestone Schedule for Sensor Simulation Software

Concurrent with the performance specifications effort will be a design analysis effort to determine the impact of the system reconfiguration functional requirements on the design of the individual system nodes. This task will clarify the interfaces necessary between the system reconfiguration software and the software in the individual nodes. It will also produce preliminary definitions of the various levels of degraded performance that would be caused by different kinds of system reconfiguration.

The program implementation will consist of two parts: producing new software elements, and revising and integrating existing software elements. The purpose of the implementation is to realize the objectives established by the functional requirements and the performance specifications documents.

The system integration and test and evaluation efforts will effect the orderly installation of the reconfiguration software and will provide a realistic appraisal of its effectiveness. The integration and test and evaluation procedures will be repeated during the years of the laboratory development as the laboratory configuration grows towards the full architecture. The operational and maintenance support will begin in the last year of laboratory development to reflect the changing status from development to operational. The work breakdown structure is shown in Figure 6-13. The task and milestone schedule is shown in Figure 6-14.

6.2.1.2.7 Utility Software. The efforts to produce utility software are intended to supply the programs needed in the operation and maintenance of the BASIC laboratory facility. Included in this category of software are programs to assist in meeting the responsibilities of configuration management, support the day-to-day software library management tasks, and enhance the efficiency and effectiveness of the BASIC laboratory operations.

The functional requirements phase of this effort includes a short-term study task to determine the specific types of software in this utility category that will be needed to support the BASIC operations and to establish a preliminary schedule

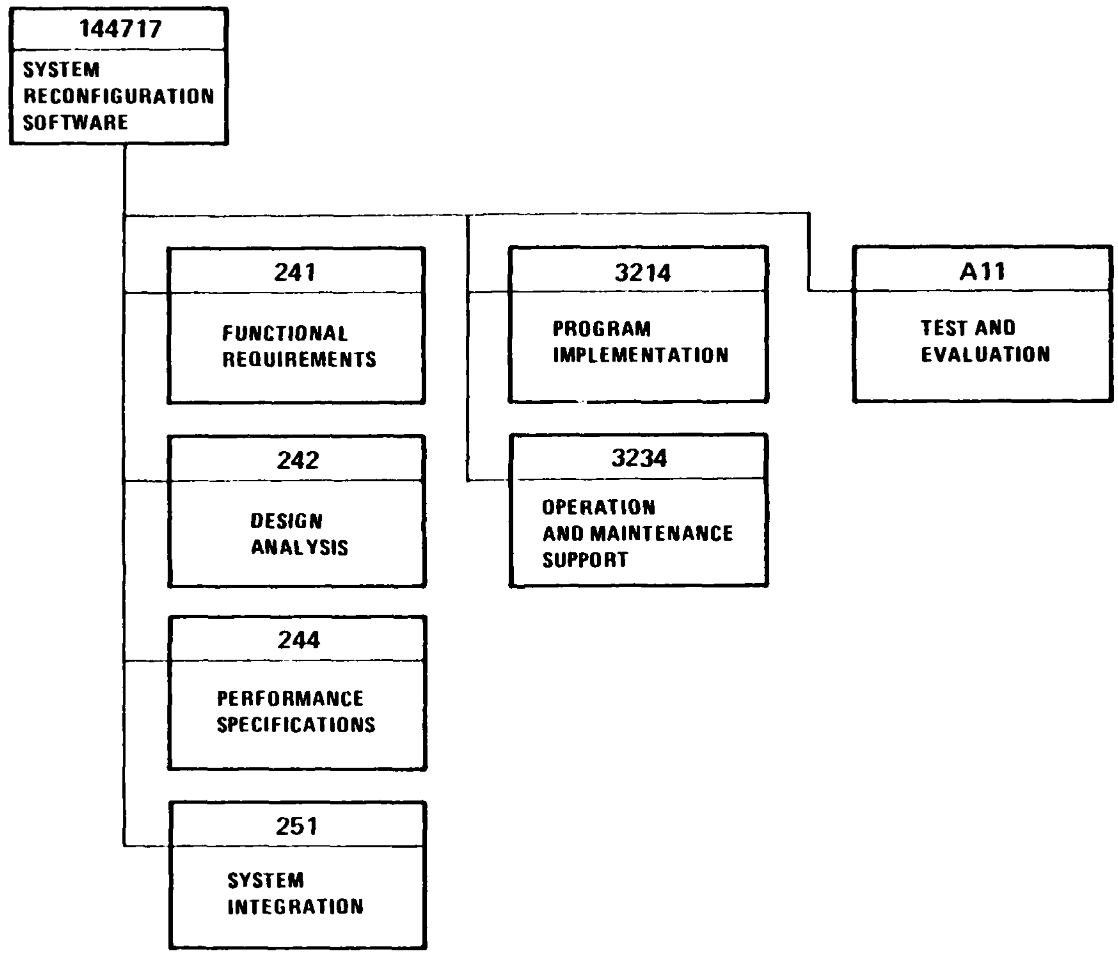

Figure 6-13. Work Breakdown Structure for System Reconfiguration Software

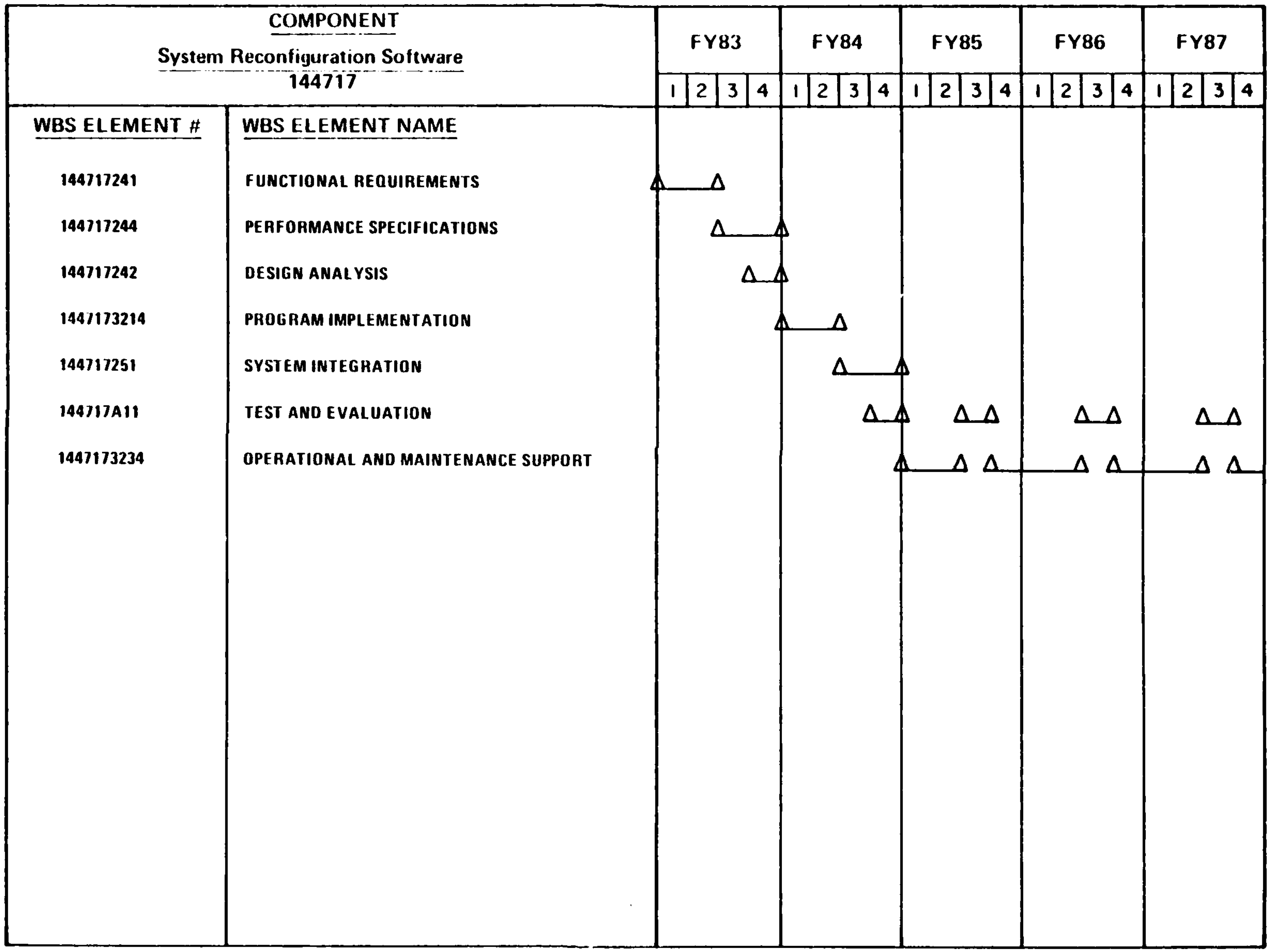

Figure 6-14. Milestone Schedule for System Reconfiguration Software

for acquiring or implementing this software. The performance specifications will serve as the basis for acquiring or implementing the software. Activities for acquiring or implementing utility software are scheduled for each year of the BASIC laboratory development effort so that the experience gained from early operations in BASIC can be used to determine the utility software needed to support operations in succeeding years.

Acceptance testing, supported by special purpose acceptance test programs, will be conducted to determine that the delivered utility software meets the specifications and qualifies for operational status in the BASIC laboratory environment.

The work breakdown structure is shown in Figure 6-15. The task and milestone schedule is shown in Figure 6-16.

6.2.1.2.8 Data Recording and Reduction Software. The data recording and reduction software efforts of the BASIC laboratory development deal with the software instrumentation of the laboratory equipment. Capturing data is the responsibility of the data recording software. Manipulating the captured data to produce reports, plot graphs, and perform calculations and correlations is the responsibility of the data reduction software.

The preparation of functional specifications and program performance specifications will define the functions to be accomplished and describe the manner in which these functions are to be performed. Accomplishment of these two milestones will set the stage for the program implementation. This part of the effort will produce more detailed specifications based on the program performance specifications and will generate the actual software elements to be installed in the BASIC laboratory.

The preparation of test programs and test data will provide a means for checking the operability of the software as it is installed in the laboratory and will also establish a tool for conducting early test and evaluation work. The

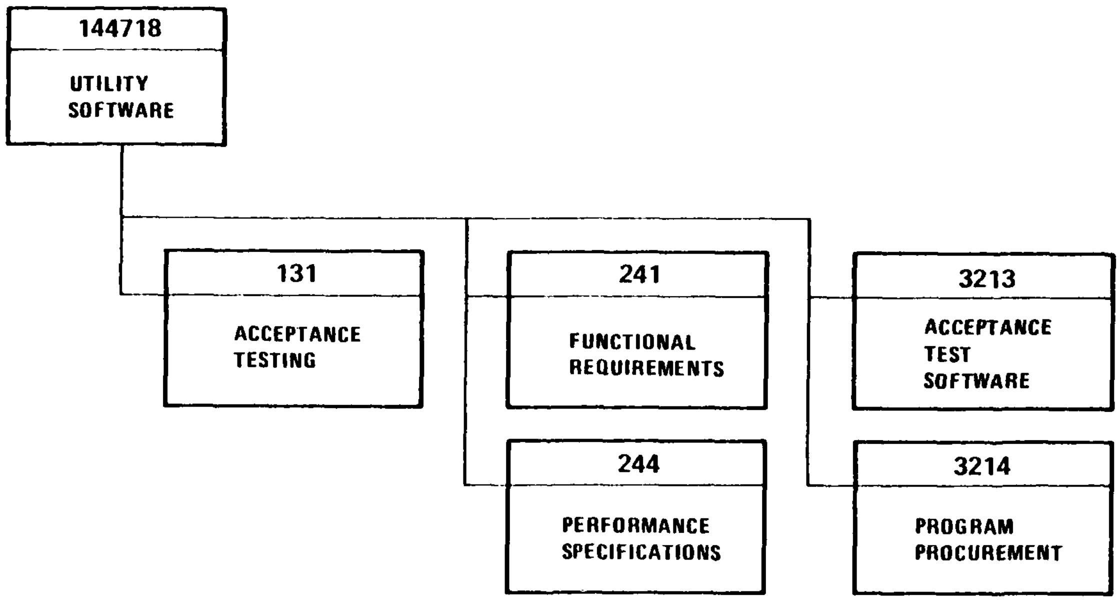

Figure 6-15. Work Breakdown Structure for Utility Software

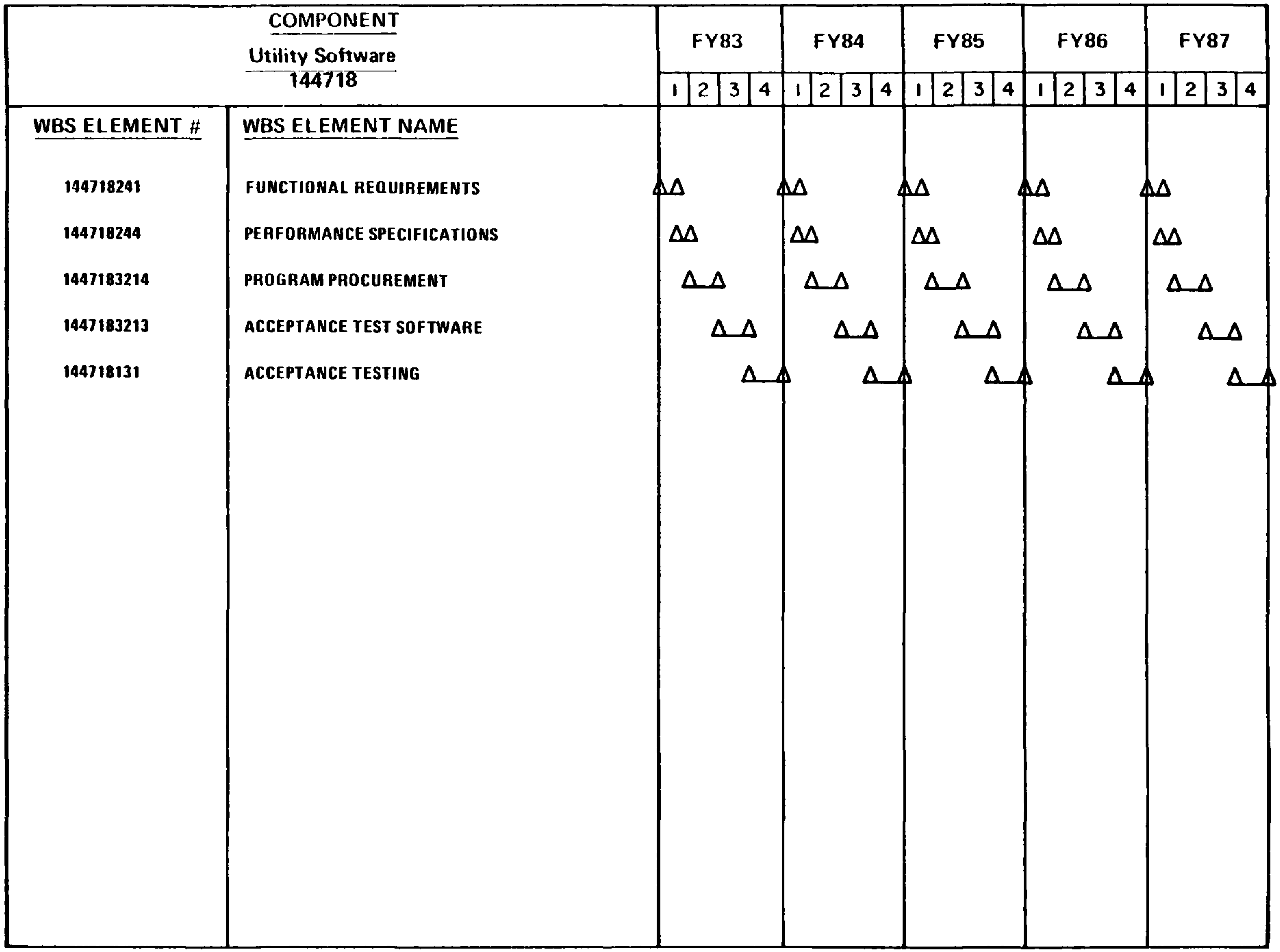

Figure 6-16. Milestone Schedule for Utility Software

test and evaluation efforts are seen as continuing throughout the laboratory development years. The goals of these efforts are:

(1) to ensure that the data recording and reduction software is meeting the functional and operational objectives in the changing and growing BASIC laboratory configuration

(2) to provide information to assist management in planning corrections and improvements in the subsequent years.

The work breakdown structure is shown in Figure 6-17. The task and milestone schedule is shown in Figure 6-18.

6.2.1.2.9 Acceptance Test Software. The acceptance test software effort of of the BASIC laboratory development includes all software development necessary to test the acceptability of hardware and software acquisitions. In the case of hardware, the acceptance test software will be used as part of the acceptance testing procedures, to determine whether the item as delivered meets minimum criteria for inclusion in the BASIC laboratory. In the case of software, the purpose to determine acceptability is similar, but the nature of the particular software item will determine the type of acceptance testing to be performed.

The approach to testing and the degree and type of acceptance testing will be described in the appropriate sections of the Program Performance Specifications. The acquisition support efforts will produce a plan for implementing the software acceptance testing software and will allocate appropriate funding for a NAVAIRDEVCEN component or outside contractor to produce this software.

Part of the responsibility of the acceptance test software effort is to schedule the acceptance testing in conformance with the acquisition schedules and to coordinate the testing with other laboratory efforts to ensure that needed resources are available as required.

The work breakdown structure is shown in Figure 6-19. The task and milestone schedule is shown in Figure 6-20.

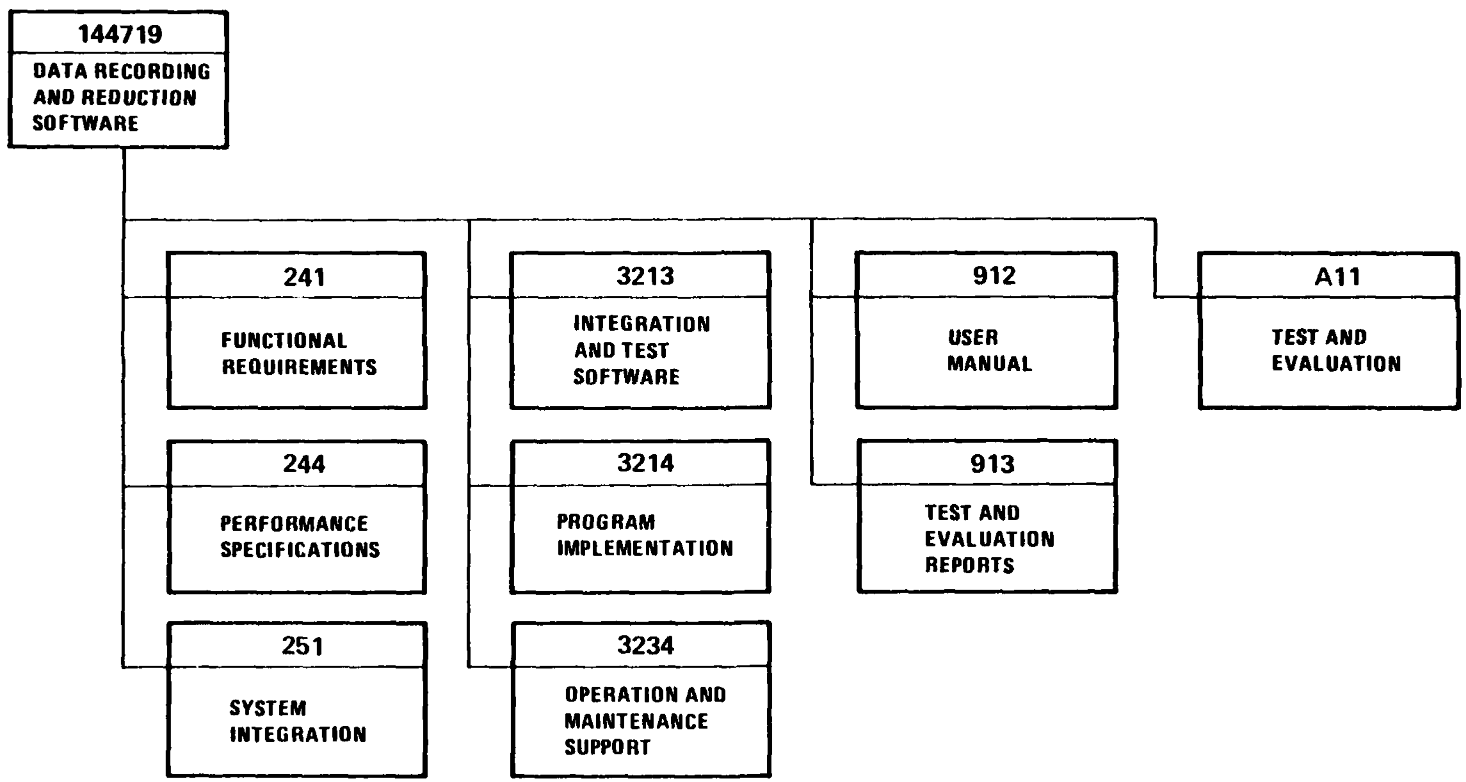

Figure 6-17. Work Breakdown Structure for Data Recording and Reduction Software

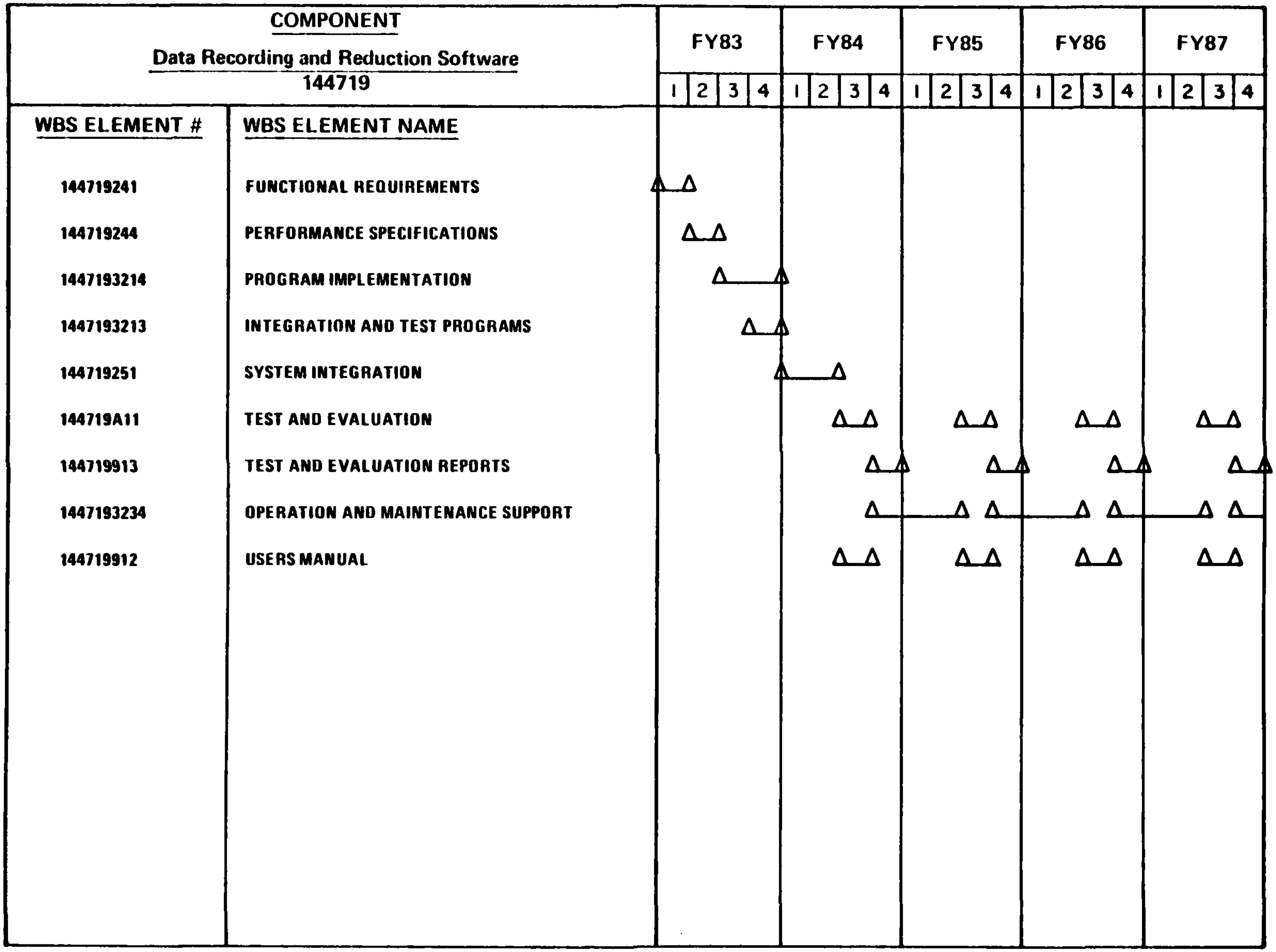

Figure 6-18. Milestone Schedule for Data Recording and Reduction Software

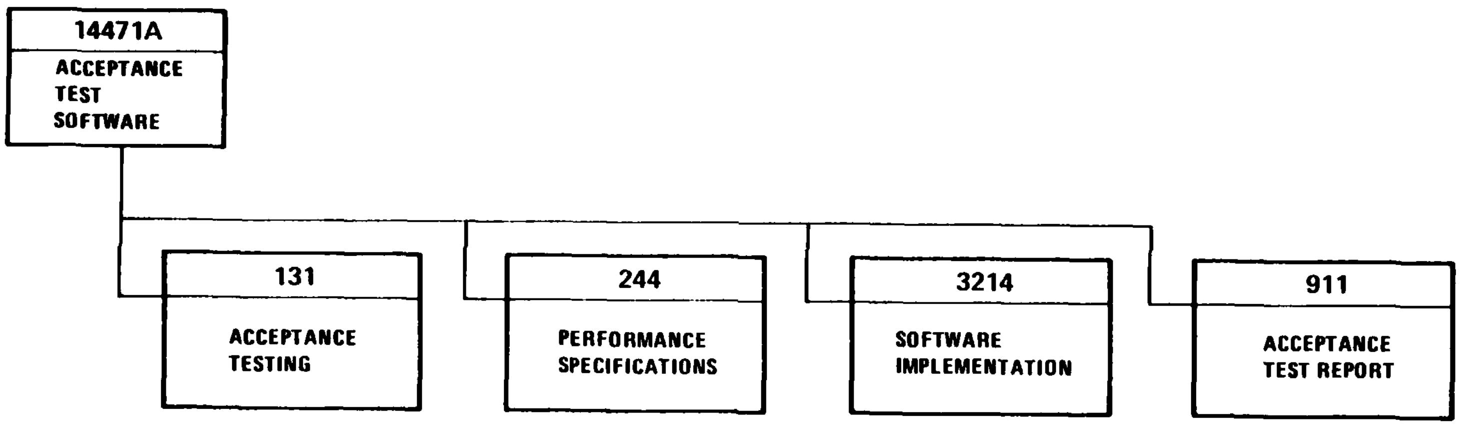

Figure 6-19. Work Breakdown Structure for Acceptance Test Software

COMPONENT Acceptance Test Software 14471A		FY83				FY84				FY85				FY86				FY87			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
WBS ELEMENT #	**WBS ELEMENT NAME**																				
14471A244	PERFORMANCE SPECIFICATIONS																				
14471A3214	SOFTWARE IMPLEMENTATION																				
14471A131	ACCEPTANCE TESTING																				
14471A911	ACCEPTANCE TEST REPORT																				

Figure 6-20. Milestone Schedule for Acceptance Test Software

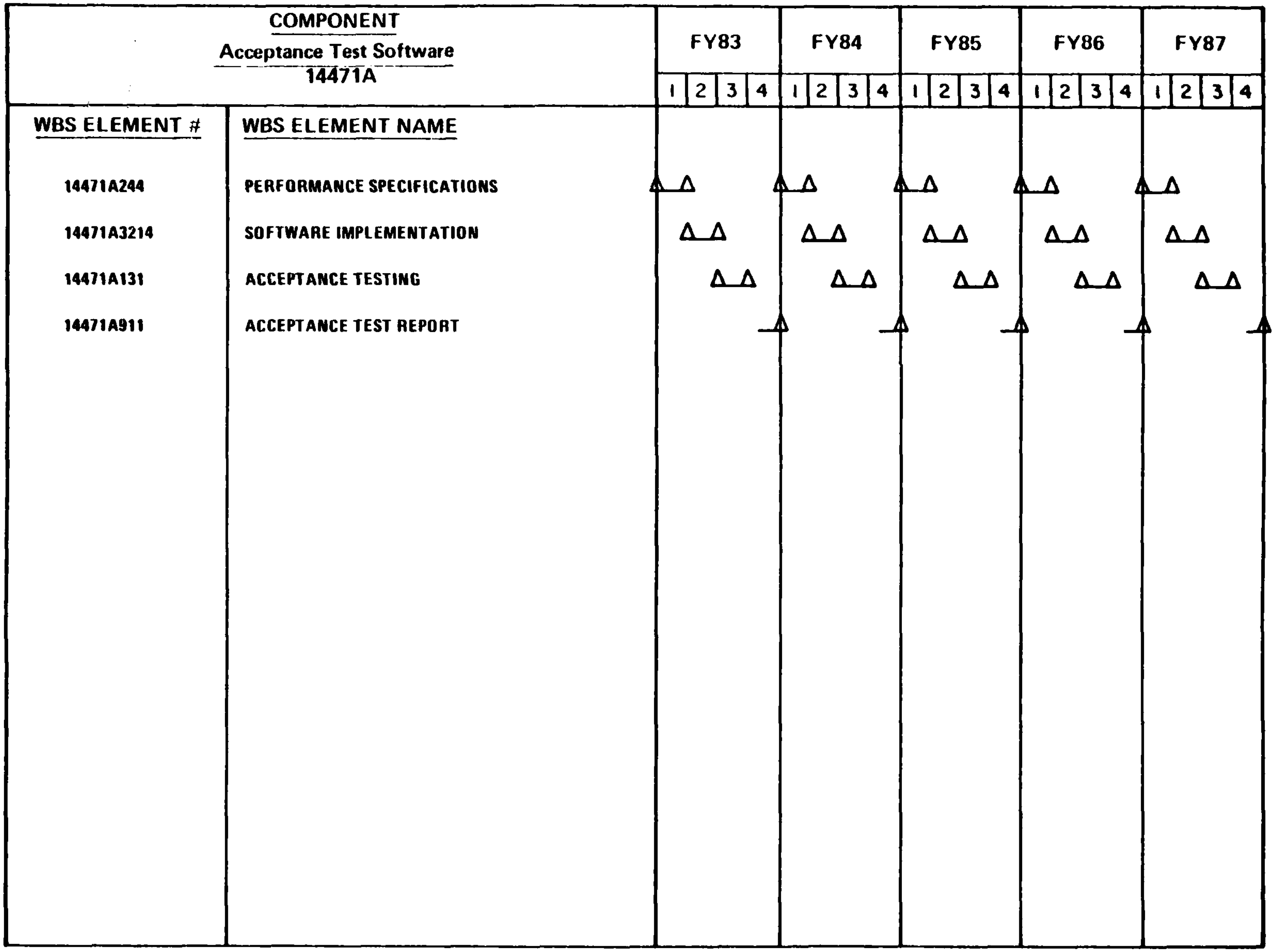

Figure 6-20. Milestone Schedule for Acceptance Test Software

6.2.2 Funding and Manpower Requirements

This section contains information on the funding and manpower requirements of the BASIC laboratory development, operation, and maintenance activities.

Figure 6-21 is a summary of funding requirements for fiscal years 1983 through 1987, broken down by major category of expenditure.

Figure 6-22 gives the proposed staffing and the required funding for this staffing.

Figure 6-23 shows the funding requirements for the proposed hardware acquisitions.

Figure 6-24 shows the software funding requirements.

6.3 OTHER TASKS

All other BASIC laboratory tasks are described in appendices. Each appendix describes a BASIC task and contains the following information:

- Description
- Work Breakdown Structure
- Schedule
- Funding and Manpower Requirements

	FY83	FY84	FY85	FY86	FY87
1. Manpower (See Figure 6-22)	800	1080	1234	1320	1320
2. Documentation, Configuration Management	240	325	290	290	290
3. Special Interface Modules and Test Equipment Design	180	260	300	240	240
4. Hardware (See Figure 6-23)	1045	1267	285	475	540
5. Software (See Figure 6-24)	725	1100	990	760	680
TOTAL	2990	4042	3079	3085	3070

Figure 6-21. Summary of Funding Requirements — BASIC Laboratory Development, Operation, and Maintenance

	FY83	FY84	FY85	FY86	FY87
Project Director	92	92	92	92	92
Secretary	50	50	50	50	50
Program Administrator	86	86	86	86	86
Assistant		73	73	73	73
Proj. System Integration Engineer	91	91	91	91	91
System Engineer			78	78	78
Lead System Software Engineer	91	91	91	91	91
Software Engineers (3)	234	234	234	234	234
Technician			78	78	78
Platform/Technology Interface Engineer		91	91	91	91
Support Engineer		39	78	78	78
Technicians (2)	156	156	156	156	156
System Test Engineer				86	86
Support Engineer		36	36	36	36
TOTAL	800	1060	1234	1320	1320

Figure 6-22. Manpower Funding Requirements —
BASIC Laboratory Development, Operation, and Maintenance

	FY83	FY84	FY85	FY86	FY87
Hardware					
Fairchild Bus Monitor	20	20	20		40
AN/AYK-14 (including CCU)	300				
Microcomputers-32 Bit-Lab and Avionics at $25K		100	25		50
VAX 11-780	200				
2 Disks RP06		180			
High Speed Printer	20	20			20
Display Terminal	2	2			
Universal Color Display and Controller (UDACS - Boeing)	300				
Hard Copy Color Printer	25				
Cockpit Mockup - Tandem		750			
- Tandem Enhancements				150	100
- Side by Side Enhancements				70	100
Z-2 8" Disk (4)	8				
Z-2 Hard Disk (2)	10			10	
Proteus I/O Channel	5				
Second CCU	30				
Spares					
AYK-14	60	20	10	10	10
Z-2	20			5	
UDAC	20				10
Microprocessor Development System	25	25			
Microcomputers 16 Bit (11 including spares)			50	10	10
MC Hard Disks (6) at $10K			30	20	10
TACCO/SENSO Positions	—	150	150	200	150
TOTAL	1045	1267	285	475	540

Figure 6-23 Hardware Funding Requirements - BASIC Laboratory Development, Operation, and Maintenance

SOFTWARE ELEMENT	WBS #	FY83	FY84	FY85	FY86	FY87
Scenario and Mission Control	144712	240	193	160	60	100
Graphic Software Package	13	30				
Control and Display	14	225	350	300	120	90
TACCO/SENSO Position	15		100	200	200	50
Sensor Simulation Software	16	50	100	70	60	50
System Reconfiguration	17		150		100	70
Utility Software	18	100	100	100	100	100
Data Recording and Reduction	19	50	75	130	100	200
Acceptance Test	1A	30	30	10	20	20
TOTAL		725	1100	990	760	680

Figure 6-24. Software Funding Requirements —
BASIC Laboratory Development, Operation, and Maintenance

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